Earth

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GENERAL

16664 A/CONF.15/P/1197
CYCLES DE COMBUSTIBLES. PRODUCTION D'URANIUM, PROGRAMME DE CENTRALES ELECTRIQUES ET EFFORT FINANCIER CORRESPONDANT. (Fuel Cycles. Production of Uranium and the Central Electric Program and Related Financial Effort.) J. Andriot and J. Gaussens (Commissariat à l'Énergie Atomique, Paris). 64p.

A number of different possible programs for nuclear power stations of various types are presented. These programs are established in relation to the use of uranium and thorium in amounts similar to those that shall probably be produced in France during the next fifteen years. As it is possible to draw plans for nuclear power stations in which several processes exist simultaneously, an unlimited number of variations being possible this survey is limited to successive analysis of the results obtained by use of only one of each of the following three systems: natural uranium–graphite, natural uranium–heavy water, and enriched uranium–pressurized light water. All schemes are considered as assemblages of these three simple systems. The effects of plutonium recycling are also considered for each system. The electric power installed and the capacity of stations situated up-stream and down-stream have been calculated by this method and an attempt has been made to establish the sum to be invested during the fifteen years necessary for the launching of the programs scheduled. A table of timing for the investments groups the results obtained. Considering the fact that French capital shall not be unlimited during the coming years, this way of presenting the results seems to be interesting. (auth)

16665 SCTM-20-59(15)
Sandia Corp., Albuquerque, N. Mex.
A SURVEY OF INFORMATION RETRIEVAL. E. C. Dowling and W. K. Paulus. May 25, 1959. 38p. Contract [AT(29-1)-789]. $1.00(OTS).

A survey of techniques for retrieving technical information is presented. A machine system large enough and fast enough for use at Sandia is suggested. Attention is also given to the necessity of proper material organizing techniques. (J.R.D.)

16666 SCTM-78-56(51)
Sandia Corp., Albuquerque, N. Mex.
HIGH "G" TESTING OF SMALL WEAPON COMPONENTS. Allan F. Beck. Apr. 25, 1956. 10p. Contract [AT(29-1)-789]. $1.80(ph), $1.80(mf) OTS.

A method is described which permits the testing of small weapon components at high "G" loads for relatively long shock duration times. "G" is the acceleration due to gravity. (C.H.)

16667 SCTM-114-59(51)
Sandia Corp., Albuquerque, N. Mex.
RELATIVE CRATERING EFFICIENCY OF NUCLEAR EXPLOSIVES. L. J. Vortman. Apr. 1959. 15p. $0.50(OTS).

This report supersedes SCTM-447-58(51).

Results of nuclear and high-explosive cratering charges fired in Nevada Test Site desert alluvium are used to determine the cratering efficiency of nuclear explosive relating to TNT. (auth)

16668
TRACING OF WATER FLOW BY MEANS OF RADIOACTIVE ISOTOPES AND SCINTILLATION COUNTERS. Knut Ljunggren, Lars-G. Erwall, and Torbjörn Westermark (Royal Inst. of Tech., Stockholm) and Jan Rennerfelt (Skogsindustriernas Vattenlaboratorium, Stockholm). Intern. J. Appl. Radiation and Isotopes 5, 204-12(1959) May.

Radioactive isotopes have been employed for determinations of residence times in sewage purification plants and also for investigations on flow patterns and dilutions in large natural waters such as lakes and river mouths because of the ever increasing use of such systems for the discharge of waste water. In the latter investigations, emphasis was laid on the use of γ-emitting short-lived tracers such as Na^{24} and Br^{82} in combination with submerged scintillation counters. This combination gives such a high sensitivity that the direct assay of concentrations of only 10^{-7} c/m^3 could be easily performed. The high sensitivity of the method is due to the large volume contributing to the signal, the high radiation absorption probability in the detector and the reduction of the background counting rate. The measurements have been carried out from small boats equipped with two-way radios, position determining instruments and battery-operated scintillation counters. Flow patterns in receivers of more than 10^8 m^3 volume have been obtained within 10 to 20 hr with about 1 c of tracer. The use of short-lived tracers and the rapid dilution produced during the experiment eliminated all health hazards due to radiation except for the easily controllable external exposure occurring during the handling of the radioactive material. (auth)

16669
TEACHING WITH RADIOISOTOPES. Harold A. Miner, Robert W. Shackleton, and Fletcher G. Watson, eds.

Washington, D. C., U. S. Atomic Energy Commission, 1959. 64p. $0.40(GPO).

Sixteen experiments are outlined which were prepared to provide high school teachers and pupils with examples of phenomena associated with radioactive materials. This manual of experiments with radioisotopes was prepared to supplement and extend a previously published list of laboratory experiments with radioisotopes prepared for high school science demonstrations. An introductory section contains definitions, notes on equipment and techniques, notes on proper procedures, and safety. A brief bibliography is included. (C.H.)

BIOLOGY AND MEDICINE

16670 AECU-4238

Iowa State Coll., Ames. Veterinary Medical Research Inst.

EFFECT OF IONIZING RADIATION ON THE VIABILITY AND ANTIGENICITY OF PATHOGENS OF DOMESTICATED ANIMALS. Progress Report (Annual) – Second Year [for] May 1, 1958 through April 30, 1959. 36p. Contract AT(11-1)-59, Project No. 10. $6.30 (ph), $3.00(mf) OTS.

A systematic investigation was made of the effects of gamma radiation on the viability and antigenicity of pathogens of domestic animals. The effects of such variables as radiation intensity, radiation dose, temperature, and suspending media were studied. The immunizing ability of radiation-inactivated preparations was investigated by established procedures. (C.H.)

16671 AERE-R-2909

United Kingdom Atomic Energy Authority. Research Group. Atomic Energy Research Establishment, Harwell, Berks, England.

RADIATION DOSIMETRY IN COBALT 60 INSTALLATION 2.C.1. G. S. Murray. Apr. 1959. 18p. $0.42 (BIS).

Dose rates have been determined in various geometrical relationships of source and sample with the object of providing extensive and accurate data for the users of this facility. The note describes the methods used, states the results graphically and in tables, gives details of the observations in an appendix and recommends good practice for making best use of the data. (auth)

16672 NP-7481

Virginia. Agricultural Experiment Station, Blacksburg.

LONG-TERM DOG-FEEDING OF IRRADIATED AND CONTROL SHRIMP AND CARROTS (PHASE 1) AND NUTRITIVE VALUE OF IRRADIATED AND CONTROL PROTEINS (PHASE 2). Progress Report No. 4 [for] six month period ending March 15, 1959. R. W. Engel and D. F. Watson. 6p. Contract DA-49-007-MD-784.

Maintainance over a two-year period on a diet which contained 35% of solids of either irradiated carrots or irradiated shrimp had no deleterious effect on reproduction, lactation, or hematological findings in dogs. Preliminary data are included from a study on the nutritional value of gamma-irradiated proteins. (C.H.)

16673 NP-7685

European Company for the Chemical Processing of Irradiated Fuels, Mol, Belgium.

TREATMENT OF PLUTONIUM POISONING: A REVIEW OF THE LITERATURE. Technical Report No. 31 (RIGO/1958/4). L. M. van Putten. Dec. 31, 1958. 14p. $3.30(ph), $2.40(mf) OTS.

A review is presented of published experimental and clinical data on treatment of accidental plutonium poisoning. It is indicated that treatment of the poisoning with zirconium citrate and calcium EDTA may be regarded as reasonably effective and safe. (J.E.D.)

16674 NP-7710

Sao Paulo, Brazil. Universidade. Instituto de Energia Atomica.

ALGUMAS CONSIDERAÇÕES SOBRE O NÚMERO DE ERITROCITOS. (Some Considerations on the Number of Erythrocytes.) R. R. Pieroni, V. Maspes, and M. A. Jamra. May 1959. 14p.

The number of red blood cells present in the circulatory system of an individual at any given instant depends on various facts, some of which are related to characteristics of the red cells themselves and some to the processes of formation and destruction. An attempt is made to establish on precise experimental data analytical expressions which relate the number of erythrocytes to parameters defined by the life span of the erythrocytes, the processes of formation and destruction, and time. (J.S.R.)

16675 NP-7711

Sao Paulo, Brazil. Universidade. Instituto de Energia Atomica.

ABSORÇAO DA VITAMINA B-12 (Co-60) EM GASTRECTOMIZADOS. (Absorption of Co^{60} Labeled Vitamin B_{12} in the Gastrectomized.) R. R. Pieroni, Jayme Rosembojm, José Schnaider, Sunaho Honda, Naum Kunsminky, Scharif Kurban, and J. F. Pontes. May 1959. 9p.

The absorption of vitamin B_{12} by individuals with a partial or total gastrectomy was investigated using B_{12} in aqueous solution containing 0.5 μc of Co^{60}/100 ml of solution. The activity in fecal and urinary eliminations is representative of the amount absorbed in the gastrointestinal tract. The results obtained are tabulated and show that in total gastrectomies most of the activity is found in the feces which contain an average of 88.25% of the total activity administered. In the controls 41% of the total activity administered was in the feces. (J.S.R.)

16676 NYO-2796

Howard Univ., Washington, D. C. Coll. of Medicine.

FINAL PROGRESS REPORT [FOR] DECEMBER 1, 1957 TO MAY 1959. Edward W. Hawthorne. May 1959. 13p. Contract AT(30-1)-1860. $3.30(ph), $2.40(mf) OTS.

A technique was developed for using electromagnetic plethysmography for the study of instantaneous dimensional changes of the left ventricle during the cardiac cycle in normal dogs and dogs with aortic insufficiency. Isotope dilution techniques, using radioactive iodinated human serum albumin as the indicator, were used to measure cardiac output, mean circulation time, appearance time, disappearance time, pulmonary blood volume, and total blood volume. Significant findings are summarized. (C.H.)

16677 TID-3531

Technical Information Service Extension, AEC.

TOXICITY AND OTHER HAZARDS OF BERYLLIUM AND ROCKET PROPELLANTS. A Literature Search. William E. Bost, comp. July 1959. 10p. $0.50(OTS).

Seventy-three references to unclassified reports on

the toxicity, occupational hazards, and safety measures regarding beryllium and certain rocket propellants, chiefly boron compounds, are compiled. (J.E.D.)

16678 UCRL-8576

California. Univ., Berkeley. Lawrence Radiation Lab. BIOSYNTHESIS OF MORPHINE (thesis). Don Robert Baker. July 1959. 217p. Contract W-7405-eng-48. $2.50(OTS).

A study was made of the biosynthesis of morphine by the opium poppy, Papaver somniferum. The plants were grown in a chamber in an atmosphere of radioactive carbon dioxide. Extensive studies on the chemistry of morphinones are described. A literature survey was made of the paper chromatography of opium alkaloids. Two methods are described which were found to work very well. Methods are described for the determination of the specific activities of the morphine type alkaloids in photosynthetic products. Reaction mechanisms are discussed. (C.H.)

16679 AEC-tr-3732

EFFECT OF DOSE AND DOSE RATE OF X-RAYS AND HIGH-SPEED ELECTRONS ON THE FREQUENCY OF MITOSIS IN TISSUE CULTURE. H. Gartner and K. Peters. Translated for Los Alamos Scientific Lab. from Strahlentherapie 92, 555-62(1953). 7p. $1.80 (ph), $1.80(mf) JCL.

A dose dependence was demonstrated in radiation-induced suppression of mitosis in tissue cultures irradiated by x rays and by high-speed electrons. The doses employed varied between 250 and 4000 r at a dose rate of 1000 r/min. A comparison of the calculated time factors for x rays and electron beams showed that the effect of dose rate differed for the two types of radiation. Data are tabulated and discussed. (C.H.)

16680

EFFECTS OF SITE OF INJECTION AND RADIATION ON TOXICOLOGY OF DIDYMIUM NITRATE. G. S. Melville, Jr., T. P. Leffingwell, and G. L. Hartwig (Randolph AFB, Tex.). A.M.A. Arch. Ind. Health 20, 23-8(1959) July.

The rare-earth mixture known as didymium (as the nitrate) was administered to rats intraperitoneally, subcutaneously, and in wound implantation. Mortality and clinical sequelae were observed. When groups of these animals were subjected to 800 r of Co^{60} γ-irradiation, mortality was increased in all treatment groups. This increase was statistically significant in the intraperitoneal experiment, and the combined effect appears to be synergistic. (auth)

16681

THE DETERMINATION OF ALPHA ACTIVITY ASSOCIATED WITH SUB-MICROGRAM QUANTITIES OF ENRICHED URANIUM IN URINE. T. C. Whitson and T. Kwasnoski (Oak Ridge Gaseous Diffusion Plant, Tenn.). Am. Ind. Byg. Assoc. J. 20, 169-74(1959) June.

A procedure was developed for routine determination of alpha activity resulting from the presence of sub-microgram quantities of enriched uranium in urine. Wet oxidation of the organic content, removal of the calcium, and two hours of electrodeposition were found necessary prior to the alpha counting. The method provides over 80% recovery of the alpha activity with a precision of about ± 0.8 counts/minute. (auth)

16682

RAPID DETERMINATION OF THE RADIOACTIVITY OF PROTEINS AND OF THE RELATIVE PROPORTIONS OF VARIOUS FRACTIONS OF RADIOACTIVE SUBSTANCES PRESENT IN LEAVES. Zh. A. Medvedev (K. A. Timiriazev Moscow Academy of Agriculture). Biochemistry (USSR) (English Translation) 23, 759-66 (1958) Nov.-Dec.

A new procedure is described, serving for the rapid assay of the specific radioactivity of leaf proteins, and for the estimation of the relative proportions of various fractions of radioactive substances present in leaves. The leaf is placed on a weighed sheet of filter paper, and struck by a spring-loaded piston; this squeezes out fluid, giving an imprint of the leaf. The imprint is treated with 10% trichloroacetic acid to fix proteins, water-soluble substances and lipids are removed by washing, and the sheet is dried and reweighed, giving the protein content of the imprint, which is calculated per unit area. The specific radioactivity of the protein is calculated from the results of measurements of the surface radioactivity of the imprints. The relative proportions of various radioactive fractions are evaluated without weighing the sheets, from measurements of surface activity of the imprints at various stages of their selective extraction with appropriate solvents. The method is quick and simple, and is applicable to mass serial determinations of specific activity of labelled substances, and of the relative proportions of such substances in the protoplasm of the leaf cells. (auth)

16683

THE ACTION OF IONIZING RADIATION ON SOME NONPROTEIN THIO-COMPOUNDS OF THE ANIMAL ORGANISM. M. B. Gintsburg (Ukrainain Sanitary Chemical Research Inst., Kiev). Biochemistry (USSR) (English Translation) 23, 795-9(1958) Nov.-Dec.

Coenzyme A activity in rat liver and brain in definite intervals after total irradiation decreases considerably compared to the normals. CoA activity in liver and brain of irradiated rats is more strongly inhibited by the action of thiol poisons than in the controls. The amount of glutathione in the liver of irradiated rats after 24 hours is somewhat increased. In all the intervals studied it is not changed in the brain. (auth)

16684

THE PROLIFERATION IN VITRO OF TISSUE TAKEN FROM TUBERS OF HELIANTHUS TUBEROSUS IRRADIATED WITH X-RAYS. Robert Jonard. Compt. rend. 248, 3603-5(1959) June 22. (In French)

The irradiation of tubers of Helianthus tuberosus (Jerusalem Artichoke) with x rays causes latent changes in their cells which are expressed later when one makes use of their tissues in an in vitro culture. (tr-auth)

16685

COMPARISON OF THE THERAPEUTIC EFFICIENCY OF HOMOLOGOUS AND HETEROLOGOUS EMBRYONIC HAEMATOPOIETIC CELLS ADMINISTERED TO LETHALLY IRRADIATED MICE. A. Lengerová (Czechoslovak Academy of Sciences, Prague). Folia Biol. (Prague) 5, 18-22(1959).

The author compares the long-term therapeutic effect of the intravenous administration of suspensions of homologous and heterologous embryonic liver cells to lethally irradiated mice. Rat embryonic liver cells did not have a favorable effect, and even hastened the death of irradiated recipients. The administration of a homologous suspension led to recovery of 62% of lethally irradiated mice, none of which died from the fourth week after exposure, i.e., during the period characteristic for delayed death. This result is in good agreement

with the concept of the graft versus host reaction as the mechanism of delayed death. The author also discusses the difference between isologous adult and homologous embryonic hematopoietic cell and possible causes of death during the early post-irradiation period in some animals treated with homologous embryonic cells. (auth)

16686

THE THERAPEUTIC EFFICIENCY OF ISOLOGOUS BONE MARROW CELLS IN LETHALLY IRRADIATED MICE C 57 BL IN DIFFERENT DONOR-RECIPIENT SEX COMBINATIONS. A. Lengerová and J. Chutná (Czechoslovak Academy of Sciences, Prague). Folia Biol. (Prague) 5, 24-7(1959).

A preliminary experiment was carried out in mice of strain C 57 BL, in which the presence of a histocompatible factor bound to the Y chromosome is presumed in males, as distinct from females. This factor is responsible for the immune reaction of males to female cells. The therapeutic efficiency of female or male isologous bone marrow administered intravenously to males or females irradiated with a dose of 900 r x rays was compared. In groups in which conditions for a reaction of the host against the graft were present (female recipient, male donor), some of the animals died, but only during the first three weeks after exposure. Delayed deaths occurred only in combinations which fulfilled conditions for a reaction of the graft against the host. The authors discuss the possibility of the participation of the two directions of the immune reaction between host and graft in the inability of homologous or heterologous hematopoietic cells to provide the same degree of protection as that afforded by isologous cells. (auth)

16687

THE EFFECT OF IN VITRO IRRADIATION OF SPLEEN CELLS ON INDUCED SPLENOMEGALY IN CHICK EMBRYOS. I. N. Kryukova (Czechoslovak Academy of Sciences, Prague). Folia Biol. (Prague) 5, 29-30(1959).

Adult fowl spleen cell suspensions were irradiated with doses of 300, 600, 900, or 1,200 r x rays and transplanted on to the allantochorion of 10-day chick embryos. Their immunological activity, evaluated by the degree of splenomegaly produced in the embryos, fell progressively as the radiation dose was increased. After 1,200 r it was almost completely suppressed. (auth)

16688

STIMULATION OF ERYTHROPOIESIS IN MICE BY PERORAL ADMINISTRATION OF THE URINE OF ANEAEMIC ANIMALS. L. Tradleček (Czechoslovak Academy of Sciences, Brno). Folia Biol. (Prague) 5, 51-7(1959).

When irradiated mice and non-irradiated controls were kept together in the same cage, erythropoiesis in the control mice was affected. During the period of anemia in the irradiated mice, an increase occurred in the degree of erythropoiesis in the controls. The method of incorporation of Fe^{59} into the erythrocytes and of the reticulocyte count was used. The addition of the urine of anemic animals to the food of normal mice resulted in an increase in the total number of reticulocytes after four days. The increase in the total number of reticulocytes caused by administering "anemic urine" was not accompanied by parallel changes in the white blood picture. It is therefore assumed that the effective substance in "anemic" urine is a substance resembling "hemopoietin." The question of the significance of the peroral effectiveness of anemic urine in relation to the structure of erythropoietin (hemopoietin) is briefly discussed. (auth)

16689

THE EFFECT OF X-IRRADIATION ON PIGEONS. M. Skalka and M. Hill (Czechoslovak Academy of Sciences, Brno and Inst. of Histology and Embryology, Brno Univ.). Folia Biol. (Prague) 5, 60-70(1959).

The death rate, survival, and weight changes in pigeons irradiated with a single total-body x irradiation in doses ranging from 540 r to 8,300 r, at a constant dose-rate of 45 r/minute, were studied. Data are summarized. (C.H.)

16690

THE INFLUENCE OF OXYGEN ON THE X-RAY INDUCTION OF STRUCTURAL CHANGES IN DROSOPHILA OOCYTES. Seymour Abrahamson (Indiana Univ., Bloomington). Genetics 44, 173-85(1959) Mar.

Through the use of x-ray dosage fractionation methods, it became possible for the first time to demonstrate in Drosophila oocytes effects of oxygen concentration on induced gross chromosomal rearrangements and to test separately the effect of different oxygen concentrations applied before, during, or after irradiation. Oxygen present at the time of irradiation results in a significantly greater frequency of half-translocations than produced in air. Anoxia (nitrogen) at the time of irradiation results in a drastic reduction in the frequency of half-translocations as compared with air. Oxygen between irradiations is not as effective as air in reducing the half-translocation frequency. Anoxia between the two x-ray fractions increases half-translocation frequency. Although a part of this effect may be by the prohibition of joining of broken ends it seems to be greater than can be expected simply on the basis of this passive role. Postoxygen treatment had no detected effect but postnitrogen exposure significantly increased the rearrangement frequency. (auth)

16691

PRODUCTION BY ALPHA PARTICLES OF FUNCTIONALLY STABLE BROKEN CHROMOSOME ENDS IN MAIZE. A. C. Faberge (Univ. of Texas, Austin, and Oak Ridge National Lab., Tenn.). Genetics 44, 279-85(1959) Mar.

Maize pollen, carrying the linked dominant markers I Sh Bz Wx, was irradiated with alpha particles from an external plutonium source, and was used to pollinate plants carrying the corresponding recessives. The resulting marker losses and endosperm mosaics were analyzed to ascertain whether alpha particles are capable of breaking chromosomes so as to generate functionally stable new ends. It was found that the ratio of stable broken ends to unstable broken ends is about 0.54 ± 0.20 or that about 35 percent of all terminal breaks are stable. X-rays or ultraviolet produce few if any stable chromosome ends in this material. (auth)

16692

THE DETERMINATION OF GALLIUM AND MOLYBDENUM IN BIOLOGICAL MATERIAL BY ACTIVATION ANALYSIS. H. J. M. Bowen (Wantage Radiation Lab., Grove, Berks, Eng.). Intern. J. Appl. Radiation and Isotopes 5, 227-32(1959) May.

Methods are described for the determination of gallium and molybdenum in biological material using the technique of activation analysis. The limits of detection

are 3×10^{-10} g for gallium and 10^{-7} for molybdenum. The method has been used to determine these elements in tomato seeds and in whole blood. Tomato seeds normally contain about 0.01 ppm of gallium and 1 to 3 ppm of molybdenum, but the latter element can be reduced by at least 95 per cent by growing the plants under conditions of molybdenum deficiency. One hundred ml of blood contains about 0.05 μg of gallium and 1.4 μg of molybdenum. (auth)

16693

THE PROBLEM OF RADIOACTIVE CONTAMINATION OF OCEANS AND MARINE ORGANISMS. E. M. Kreps (Pavlov Inst. of Physiology, Academy of Sciences, U.S.S.R.). Izvest. Akad. Nauk S.S.S.R., Ser. Biol., No. 3, 321-34(1959). (In Russian)

A review is given based on the materials of the second Geneva International Conference on the use of atomic energy for peaceful purposes held in September 1958. Disposal of radioactive wastes and contamination of oceans and of its inhabitants are discussed, particularly in connection with nuclear and hydrogen bomb tests. (auth)

16694

NATURAL RADIOACTIVITY OF ZONAL SOILS OF THE EUROPEAN PART OF THE SOVIET UNION. M. T. Yastrebov (Moscow State Univ.). Izvest. Akad. Nauk S.S.S.R., Ser. Biol., No. 3, 391-402(1959). (In Russian)

Natural radioactivity of zonal soils and of their soil forming rocks up to 220–240 cm in depth as well as of the suprasoil air at a 20 cm altitude from the soil surface has been studied from 29.VIII to 13.X 1957 in the natural zones of the European part of the USSR located along the meridian from the Arkhangelsk taiga down to the southern coast of Crimea. The measurements were carried out by mica counters (BFL-T-80 and Si-2b), by an aluminum (AS-2) and glass copper cathode (MS-4) which registers α, β-soft, β-hard and γ-radiation, respectively with the aid of a field radiometric device PK-10b and a spherical and hemispherical 9-cm lead shield. It was found that natural radioactivity of zonal soils increased in the following order: highly podzol on carbonate moraine (Arkhangelsk region), sod-highly podzol soil on loess-like loam (Vologodsk region), sod-medium podzol soil on loess-like loam (Moscow region), light-gray forest soil on loess loam (Tula region), powerful leached chernozem on loess-like loam (Kursk region), dark chestnut on carbonate loess-like loam (Kherson region) brown forest on slate schists (Crimea region). A 5-mm superficial layer of the accumulative A_1 horizon invariably showed maximal natural radioactivity in all kinds of soil surpassing the natural radioactivity value of the lower A_1 horizon and of all soil horizons and rocks by 2.2-3.5 times. In the podzol A_2 horizons a decrease of natural radioactivity was mostly noted as compared with the natural radioactivity value of the accumulative A_1 horizon. In the alluvial horizon (B_1 and B_2) natural radioactivity increases by 12 to 33% when compared with natural radioactivity of the A_1 horizon. Most of the soil-forming rocks tested showed a lesser natural radioactivity (by 33 to 50%) than natural radioactivity of the accumulative (A_1) and alluvial (B_1 and B_2) soil horizons which have developed on these rocks. (auth)

16695

THE EFFECT OF Co^{60} γ-RAYS UPON RIBOFLAVINE SYNTHESIS BY YEASTS. L. A. Seliverstova (Microbiological Inst., Academy of Sciences, U.S.S.R., Moscow). Izvest. Akad. Nauk S.S.S.R., Ser. Biol., No. 3, 412-17(1959). (In Russian)

Gamma radiation of Co^{60} causes significant changes of riboflavine synthesis in the proximal progeny of the irradiated yeast cells and yeast-like organisms. The amount of free and loosely bound riboflavine in the proximal cell generation of Saccharomyces cerevisiae, strain A, irradiated with 60 and 100 kr is reduced by 40 to 50% versus the non-irradiated yeasts. The total riboflavin content of these cells is 25 to 30% less than in the control ones. With the increase in the irradiation dose the capacity to accumulate riboflavin from the nutrient medium increases in the next progeny of the irradiated Saccharomyces cerevisiae cells, strain A. With the increase in the irradiation dose the content of free and loosely bound riboflavin increases in the next generations of the irradiated cells of yeast-like organisms such as Torulopsis utilis and Candida Guilliermondii. (auth)

16696

THE STATE OF THE HIGHER NERVOUS ACTIVITY IN RATS SUBJECTED TO DAILY X-RAY IRRADIATION AT THE STAGE OF EMBRYONIC DEVELOPMENT. V. N. Semagin (Inst. of Nervous Activity, Academy of Sciences, U.S.S.R.). Med. Radiol. 4, No. 6, 16-21 (1959) June. (In Russian)

Studies on the higher nervous activity after L. I. Kotlyarovsky's method are presented. Investigations were conducted on daily irradiated (10 r for a course of 20 days) rats during their embryonic development. Statistically confirmed data on the weakening of the excitation process were revealed. These changes are detected in stereotype work and in the employment of special tests. The relation of the weight of the brain to that of the body shows an inhibition of the brain development of the irradiated rats amounting to 13.5%. (auth)

16697

TEMPERATURE DISORDERS IN DOGS IN MASSIVE IRRADIATION. N. A. Volokhova. Med. Radiol. 4, No. 6, 22-7(1959) June. (In Russian)

Experiments on dogs revealed that irradiation (15,000 to 30,000 r) provokes temperature changes in the organism throughout the course of acute radiation sickness development. Irradiation in the above doses produces a difference in the temperature changes of the irradiated organism, and preserves the capacity of active heat emission regulation in elevated temperature of the external environment. (auth)

16698

DISTURBANCES OF BASAL METABOLISM ADAPTATIONAL CHANGES IN RATS SUBJECTED TO X-RAY IRRADIATION. A. Vacek (Inst. of Biophysics, Czechoslovak Academy of Sciences). Med. Radiol. 4, No. 6, 27-32(1959) June. (In Russian)

In experiments on white rats the consumption of oxygen, the expiration of carbon dioxide, and the R. Q. change during the course of a 10-minute irradiation were studied. The dose power was — 5, 10, 20, 50, and 100 r/min. An elevated oxygen consumption and a drop of the R. Q. was observed in all the irradiated animals. Two types of reactions were distinguished: animals of the first type react by oxygen consumption increase depending upon the irradiation dose; in animals of the second type the oxygen consumption drops. In control animals a reduced oxygen consumption is observed simultaneously with the R. Q. ratio increase. The results of the experiments are discussed. (auth)

16699

THE COURSE OF RADIATION SICKNESS IN DOGS WITH EXTIRPATED LYMPHOID ORGANS. Yu. M. Zaretskaya. Med. Radiol. 4, No. 6, 32-7(1959) June. (In Russian)

Experiments conducted on dogs show that the removal of lymphoid organs complicates the course of radiation sickness following x irradiation in the dose of 400 r. The weakening of the function of the reticuloendothelial system played the main role in the decrease of the organism's resistance to the action of ionizing radiation. (auth)

16700

THE INFLUENCE OF IONIZING RADIATION ON THE BODY IN DIFFERENT HISTIDINE CONTENT IN THE FOOD. A. E. Sharpenak, O. A. Shishova, and L. A. Gorozhankina (Nutrition Inst., Academy of Medical Sciences, U.S.S.R.). Med. Radiol. 4, No. 6, 37-41 (1959) June. (In Russian)

Studies on the effect of ionizing radiation, carried out against the background of diets containing different amounts of histidine, revealed that the activity of liver histidase sharply increases in rats receiving low histidine diets, aggravating the histidine deficiency of the food. In 10 to 15 days following irradiation the leukocyte count decrease is less pronounced in rats receiving a surplus of histidine with food. The drop of the content of globin, heme, erythrocytes in the blood and a decrease of the weight of the spleen observed in a number of irradiated rats may, in the majority of cases, be alleviated by raising the histidine content in the food. In 10 to 15 days following irradiation the blood pressure tends to rise, which is sharply marked in animals receiving low histidine diet. Extracts of the liver and other organs of irradiated rats given deficient or normal content of histidine with food, completely lose the ability to absorb oxygen in their incubation with histamine. The tissues of animals given a surplus of histidine retain this ability. Histidine lowers the unfavorable action of ionizing radiation on the organism. The latter should be taken into consideration in the elaboration of prophylactic diets against radiation sickness. (auth)

16701

ROENTGENOLOGICAL CHANGES OF THE GASTROINTESTINAL TRACT IN PUPPIES OF DIFFERENT AGE UNDER THE INFLUENCE OF X-RAY IRRADIATION. T. D. Mirimova (Inst. of Pediatrics, Academy of Medical Sciences, U.S.S.R.). Med. Radiol. 4, No. 6, 41-7(1959) June. (In Russian)

The results of roentgenological investigations of the functional state of organs of the gastrointestinal tract in puppies of different age, affected with acute radiation sickness, are presented. The importance is shown of the roentgenological method for the determination and study of functional disturbances in the gastrointestinal tract of puppies in acute radiation sickness. The unorganized character of the gastrointestinal activity of young puppies observed in normal conditions, increases in 24 hours following total irradiation even in minimum lethal dose (200 r). Especially pronounced disturbances are noted in the small intestine. Changes in the gastrointestinal tract, approaching those seen in adult dogs, are found in puppies over 3 months old. Confrontation of personal and literature data point to the fact, that the leading part in the formation of the gastrointestinal syndrome is played not only by the ionizing radiation affection of the gastrointestinal tract, but by the simultaneous affection of the central nervous system as well. (auth)

16702

THE PATHOGENESIS OF ADENOSINETRIPHOSPHATASE ACTIVITY RISE IN THE SPLEEN UPON IRRADIATION OF THE HEAD WITH A DOSE OF 4,500 r. E. A. Prokudina (Central Research Inst. of Medical Radiology). Med. Radiol. 4, No. 6, 47-51(1959) June. (In Russian)

Experiments were staged on white rats. Upon irradiation of the head with a dose of 4,500 r the author has observed a rise of the adenosinetriphosphatase activity in the spleen. A maximal rise of the enzyme activity was noted on the 5th day following irradiation, reaching 143%. The data obtained testify to the indirect character of changes observed. Analysis of specific forms of the indirect influence of penetrating radiation show it to be of a neurohumoral nature. The suprarenals play an essential part in the adenosinetriphosphatase activity rise in the spleen following irradiation of the head. However, their pathogenetic influence is fully realized only when the innervation of the organ under study is intact. (auth)

16703

MORPHOLOGICAL CHANGES OF THE THYROID GLAND IN RATS OF DIFFERENT AGE IN TOTAL X-RAY IRRADIATION. E. A. Loskutova (Pavlov Inst. of Physiology, Academy of Sciences, S.S.S.R.). Med. Radiol. 4, No. 6, 51-5(1959) June. (In Russian)

The reaction of the thyroid gland of white male rats to x irradiation (800 r) depends upon the age and individual reactivity of the animal. In young rats the irradiation provokes marked changes in the thyroid gland, which in some instances are expressed by an insignificant rise of the activity (in the first hours and days after irradiation) followed by its decrease (from the 5th to 30th day). In other cases a drop of the activity is seen already in the first hours. In all rats of this group the thyroid gland reverts to normal towards the second month. In adult rats (5–7-month-old) the above dose of irradiation provokes less pronounced changes in the structure of the gland, as compared to young rats. Towards the 18th day after irradiation the structure of the thyroid gland normalizes. Irradiation (800 r) of old rats does not cause noticeable changes in the histological picture of the thyroid gland. In young rats with a severe course of radiation sickness, sacrificed in the agonal state on the 9th–13th day following irradiation, there is a sharp drop of the thyroid gland activity. (auth)

16704

EXPERIMENTAL ANTHRAX INFECTION IN IRRADIATED ANIMALS. A. P. Krasilnikov and N. A. Izraitel (Minsk Medical Inst.). Med. Radiol. 4, No. 6, 56-61 (1959) June. (In Russian)

The experiments were staged on white mice. The following was studied: the natural resistance of irradiated animals to experimental infection with B. anthracis in dependence to the terms of infection following irradiation, the doses of irradiation and the site of introduction of the infectious matter; the time of the onset and the duration of bacteremia and dissemination of various organs; quantitative characteristic of bacteremia and accumulation of bacilli in the liver. The investigations revealed that single total sublethal irradiation (342 r) of white mice lowers the resistance

of the animals to anthrax infection. The resistance falls already in the first 24 hours, the decrease is considerably marked in 3 days, while the maximum is reached on the 7th day. The resistance is fully restored 12 to 21 days following the action of ionizing radiation. The diminution of resistance of an irradiated organism to anthrax infection is more pronounced in experiments with massive x-ray irradiation (550 r). In subcutaneous and intraperitoneal infection there is a drop of the resistance of the organism of white mice subjected to the action of ionizing radiation. In intranasal and peroral modes of infection no noticeable difference in the irradiated and control animals was observed. Experimental anthrax infection at the period of radiation sickness development results from considerably lesser doses of the infectious agent. Moreover, the infection develops 1 to 1½ days sooner, runs a course with dissemination of a larger number of organs and accumulation in the latter of vast numbers (in comparison with control animals) of bacilli, giving a considerably larger lethality than in the control animals. (auth)

16705

THE EFFECT OF ACTH AND CORTISONE ON THE COURSE AND OUTCOME OF RADIATION SICKNESS IN WHITE RATS OF DIFFERENT AGE. M. V. Propp (Pavlov Inst. of Physiology, Academy of Sciences, S.S.S.R.). Med. Radiol. 4, No. 6, 61-4(1959) June. (In Russian)

The effect of cortisone and ACTH administration on the course of radiation sickness in rats of different age was studied. Cortisone administered in the dose of 0.5 to 1.25 ml produces an unfavorable effect on the course and outcome of radiation sickness in all the irradiated rats (the dose was 800 and 1,000 r, irrespective of age). (auth)

16706

THE ACTION OF IONIZING RADIATION ON PRESERVED BLOOD AND PLASMA. V. N. Vorob'ev, Z. I. Sheremet, and M. O. Raushenbakh (Central Order of Lenin Inst. of Hematology and Blood Transfusions). Med. Radiol. 4, No. 6, 65-73(1959) June. (In Russian)

The injurious effect of ionizing radiation on stored blood is manifested by a drop in the minimal osmotic resistance of erythrocytes, acceleration of their spherulation and hemolysis, i.e., changes characterizing preserved blood of prolonged storage life. The degree of the deleterious action depends upon the irradiation dosage and the individual properties of the blood. Noticeable changes (hemolysis, spherulation) in the freshly stored blood occur, as a rule, on the 7th day following the irradiation. The results of biochemical investigations of the irradiated preserved blood show a more rapid drop of the intensity of exchange processes. The irradiation dose of 50,000 r does not change noticeably the protein system of native and dry plasma. The transfusion of preserved blood, irradiated with a dose of 10,000 r in the first 5 days of storage life, does not cause any material clinical or hematological changes in the animals. The results of the studies give ground for the conclusion that preserved blood, subjected to gamma-radiation, is quite suitable for transfusions, under the condition that there are no signs of damage. The latter could be determined by the routine tests, characterizing the quality of the stored blood, in particular the absence of hemolysis. (auth)

16707

DATA ON THE DISTRIBUTION OF Pm^{147}. Yu. I. Moskalev. Med. Radiol. 4, No. 6, 73-5(1959) June. (In Russian)

The distribution of Pm^{147} in the organs of rats upon intravenous and peroral administration was studied. It has been established that Pm^{147}, upon intravenous introduction, is deposited mainly in the liver (44.4%) and skeleton (28.4%). It excretes almost exclusively with the feces. Pm^{147} is not adsorbed from the intestine. (auth)

16708

THE ACTION OF Pu^{239} AND $Sr^{89,90}$ ON THE BONE MARROW OF WHITE RATS. S. R. Tsarapkin and Z. G. Sych. Med. Radiol. 4, No. 6, 75-7(1959) June. (In Russian)

In experiments on rats the reaction of the bone marrow to intraperitoneal administration of 1.5 mc/g of $Sr^{89,90}$ and 0.0035 mc/g of Pu^{239} was studied. Analysis of the bone marrow on the 3rd, 8th, 16th, and 32nd day following the introduction of the isotope shows a larger sensitivity of cells of the erythropoietic series in comparison with cells of the granulopoietic series. The analysis also revealed the presence of the initial hypergenerative phase, increase of the number of generating cells, and pathological mitoses. The bone marrow reaction as affected by plutonium, as opposed to strontium, is characterized by inhibition of the hypogenerative phase and lesion of reticuloendothelial and histocytic cells. (auth)

16709

THE PERMEABILITY OF RADIUM BROMIDE THROUGH INTACT SKIN. M. A. Khodyreva. Med. Radiol. 4, No. 6, 77-81(1959) June. (In Russian)

An experimental investigation is reported on the possibility of passage of radium bromide through intact skin of animals. The experiments were staged on rabbits. The permeability of radium bromide was assessed by determining the radioactivity in the blood with the aid of a sensitive method of photographing alpha particles on thick plates. During the experiments the author studied the behavior of the animals, their weight, and the state of the peripheral blood. A solution of radium bromide applied in the concentration of 4 mc/cm^2 of skin surface passes through the intact skin of rabbits. A regularity of specific activity increase of the blood has been observed. A change of the leukocyte content in the peripheral blood has been noted in animals subjected to the action of radium. The weight loss of experimental animals is in direct dependence to the duration of radium salt action on the skin. (auth)

16710

VARIATION OF SENSITIVITY TO IONIZING RADIATION WITH AGE. M. L. Crosfill, Patricia J. Lindop, and J. Rotblat (St. Bartholomew's Hospital, London). Nature 183, 1729-30(1959) June 20.

A considerable variation in radiosensitivity was observed in mice throughout the life-span. The variability was particularly evident at a young age. None of the theories which have been advanced to explain the effects of radiation accounts for this variation. Data are presented from a systematic study of the long-term effects of radiation in mice. (C.H.)

16711

EFFECT OF X-IRRADIATION ON PLASMA, LIVER, AND BONE MARROW LIPIDS OF THE RABBIT. E. E. Elko and N. R. Di Luzio (Univ. of Tennessee, Memphis). Radiation Research 11, 1-6(1959) July.

Plasma, liver, and bone marrow lipid fractions of rabbits were determined 24 hours after 1000 r of whole-body x irradiation. Plasma phospholipid, cholesterol,

and total lipid fractions in the x-irradiated groups were markedly elevated above the control values. Although no alteration was noted in liver cholesterol concentration, liver phosphatide and neutral fat fractions were significantly increased in the x-irradiated group. The cholesterol, phospholipid, and neutral fat fractions of bone marrow, obtained either from the femur or from other bone marrow sites, showed no significant alteration in the x-irradiated group. These findings indicate that bone marrow lipids do not contribute to the postirradiation hyperlipemia, nor are they markedly altered 24 hours after lethal whole-body x irradiation. (auth)

16712

EFFECT OF X-IRRADIATION ON INCORPORATION OF UREIDOSUCCINIC ACID-C^{14} INTO NUCLEIC ACID PYRIMIDINES. C. Y. Yen, E. P. Anderson, and Paul K. Smith (George Washington Univ., Washington, D. C.). Radiation Research 11, 7-17(1959) July.

A detailed investigation of the incorporation of ureidosuccinic acid-C^{14} into nucleic acid pyrimidines has been made on normal and x-irradiated mice. Total-body x irradiation of 400 r inhibited uptake of this compound into individual DNA pyrimidines, particularly in spleen, and produced increased incorporation into PNA pyrimidines in both liver and spleen. In a series studied at various times after irradiation, total activity in cold and hot TCA fractions of liver and spleen also tended to be above that of normal animals, particularly at 92 hours after irradiation; the effect was less marked at earlier periods, and at 68 hours after irradiation the activity in the hot TCA fraction was actually below the normal level. This may indicate that inhibition or stimulation of the incorporation of this compound by x irradiation is a function of the time period after irradiation. (auth)

16713

NONIONIZING RADIANT ENERGY AS AN AGENT IN ALTERING THE INCIDENCE OF X-RAY-INDUCED CHROMATID ABERRATIONS. III. ACTION SPECTRUM OF FAR-RED POTENTIATION. C. C. Moh and R. B. Withrow (Smithsonian Institution, Washington, D. C.). Radiation Research 11, 18-23(1959) July.

Five different wavelengths (730, 760, 780, 810, and 820 mμ) and two levels of irradiance (1500 and 200 $\mu w/cm^2$) were employed to determine the action spectrum of the potentiating effect of far-red radiant energy on x-ray-induced chromatid aberrations in Vicia root tips. It was found that radiant energy in the region from 760 to 780 mμ was most effective in increasing the aberrations. Probably an irradiance of 200 $\mu w/cm^2$ is the threshold for the induction of the potentiation in Vicia. (auth)

16714

THE DIFFERENTIAL ACTION OF IRRADIATED AND CHEMICALLY TREATED MARROW ON SURVIVAL AND ON THYMIC REGENERATION IN IRRADIATED MICE. Irwin Berman and Henry S. Kaplan (Stanford Univ., San Francisco). Radiation Research 11, 24-9(1959) July.

Bone marrow from x-rayed, thio-TEPA-, and urethan-treated donors failed to promote thymic regeneration in sublethally irradiated animals, whereas the same number of cells from the same marrow pools were effective in protecting against the effects of lethal doses of irradiation. The implications of these results are discussed. It is concluded that there are at least two factors or mechanisms of action by which bone marrow independently promotes thymic regeneration and survival in x-irradiated animals. It is considered highly unlikely that isologous bone marrow promotes thymic regeneration simply by repopulating the irradiated thymus gland. (auth)

16715

THE EFFECTS OF ALPHA-PARTICLE IRRADIATION ON I^{131}-LABELED IODOTYROSINES. Rosalyn S. Yalow (Veterans Administration Hospital, Bronx, N. Y.). Radiation Research 11, 30-7(1959) July.

The principal radiation-induced alteration after α-particle irradiation of monoiodotyrosine (T_1) or diiodotyrosine (T_2) is deiodination with hydrogen substitution. Although the T_2 molecule is slightly larger and absorbs more energy from the incident beam, the inherent stability of T_2 results in the latter having an apparently smaller cross section or sensitive volume. Chemical structure as well as molecular size is important in determining the radiosensitivity of these molecules. (auth)

16716

IRRADIATION OF SOLUTIONS OF TRANSFORMING DNA. F. M. Defilippes and W. R. Guild (Yale Univ., New Haven). Radiation Research 11, 38-53(1959) July.

Transforming DNA has been irradiated in solution over a wide range of concentrations, and the ionic yield determined for inactivation of the biological transforming activity. The D_{37}'s ranged from 65 r to several thousand roentgens, depending on the DNA preparation and the concentration. The maximum observed yield indicated that a mass of 500,000 molecular weight was inactivated per ion pair, which corresponds rather closely to the sensitivity observed for direct action also. No aftereffect of irradiation was observed, nor was an effect of removing O_2 found. It appears that in sufficiently pure solutions one may observe the effect of at least two intermediates, suspected as being OH and H. It may be concluded that in vitro a radical has a probability near unity of inactivating a DNA molecule biologically if it gets to the molecule, but that in vivo relatively few of the radicals produced probably do find the DNA. (auth)

16717

MAGNETIC CENTERS (FREE RADICALS) PRODUCED IN CEREAL EMBRYOS BY IONIZING RADIATION. Alan D. Conger and M. L. Randolph (Oak Ridge National Lab., Tenn.). Radiation Research 11, 54-66(1959) July.

Barley seeds, barley embryos, and wheat embryos (ground wheat germ) were irradiated with x and γ rays and then examined for the presence of magnetic centers (assumed to be radicals) by electron paramagnetic spin resonance methods. Results are presented graphically and discussed. (C.H.)

16718

THE ABILITY OF EXTRINSIC GONADOTROPIN (FSH) TO FUNCTION WHEN ADMINISTERED AFTER SUBLETHAL AND LETHAL X-RAY EXPOSURES. J. F. Spalding, S. B. Hawkins, and V. G. Strang (Los Alamos Scientific Lab., N. Mex.). Radiation Research 11, 67-71(1959) July.

Mature female mice were given x-ray doses ranging from 300 to 19,200 rads and treated with FSH. Sixteen to 18 hours after treatment, the mice were killed and the number of ovulations was determined. At above lethal doses, where induced ovulation was prevented, follicular ova were observed to determine the stage of maturation. X-ray exposures up to and including 12,000 rads did not prevent ovulation. Doses of 13,200 to 14,400 rads reduced the number of ovulations, and an

x-ray dose of 19,200 rads prevented ovulation. There was much evidence to indicate that ovulation was prevented at 19,200 rads by damage to the estrogen-producing tissue. (auth)

16719

INACTIVATION OF PEPSIN BY ROENTGEN RADIATION. II. EFFECT OF DIFFERENT ENZYME CONCENTRATIONS OR VARIOUS ORGANIC COMPOUNDS. M. K. Loken, K. W. Stenstrom, J. F. Marvin, and D. G. Mosser (Univ. of Minnesota, Minneapolis). Radiation Research 11, 72-8(1959) July.

The activity of pepsin exposed to roentgen irradiation was found to depend on the concentration of the enzyme during irradiation and the addition of organic compounds to the enzyme solution before radiation exposure. Pepsin was found to provide a significant self-protection from radiation inactivation. Albumin protected pepsin from radiation to a degree which is comparable to that provided by pepsin itself. Hematoporphyrin, cysteamine, cysteine, glucose, and sucrose all protected the enzyme when present in the solution during the irradiation. Low concentrations of hematoporphyrin provided the same protection as that observed with concentrations of glucose which were about one hundred times higher. As the concentration of hematoporphyrin was increased above 10^{-4} M, its antiproteolytic effect became manifest so that its effectiveness as a radioprotective agent was impaired. At concentrations of 10^{-3} M or greater, cysteamine afforded the greatest protection of all chemicals used. (auth)

16720

RECOVERY OF X-IRRADIATED RABBIT LENSES. E. F. Riley, R. D. Richards, and P. J. Leinfelder (State Univ. of Iowa, Iowa City). Radiation Research 11, 79-89(1959) July.

Previous experiments had demonstrated recovery, even after exposures of 11,000 rads, if a portion of a rabbit lens including at least one-fourth of the peripheral epithelium was shielded during the x irradiation. Recovery was indicated by the fact that opacification of partially shielded lenses did not become complete even though the opacification did become complete after similar exposures of the entire lens. A few of the partially shielded lenses were observed for as much as 3 years after irradiation. This earlier study had shown that a shielded portion was essential for recovery but did not indicate how this portion contributed to the recovery or how complete the recovery was. For the present study, one half of a lens was exposed to 11,000 rads, and, at various times afterward, the second half was also exposed to 11,000 rads. If the interval between exposures was 3 months or less, the resultant opacification invariably become complete. When the interval was 4 months or more, the lenses generally did not become completely opaque. Accordingly, it was presumed that the first half had recovered sufficiently in 4 to 5 months to sustain the lens and make a recovery possible when the second half of a lens was in turn irradiated. (auth)

16721

PHYSICOCHEMICAL EFFECTS OF RADIATION. IV. EFFECTS OF HIGH-SPEED ELECTRONS ON HUMAN FIBRINOGEN. Raymond Sowinski, Lubomyra Oharenko, and Virgil L. Koenig (Northwestern Univ., Chicago). Radiation Research 11, 90-100(1959) July.

High-speed electron irradiation of human fibrinogen in the dry state and then dissolved in 0.5 M NaCl showed changes in sedimentation, viscosity, solubility, and light-scattering behavior. Fragments having an average S_{20} value of 1.00 S were produced. Insoluble aggregates or polymers were produced in considerable amount. The intrinsic viscosity decreased progressively with increase in irradiation dosage. The molecular weight as determined by light-scattering decreased progressively with increase in irradiation dosage. The preparation of human fibrinogen studied seemed more susceptible to irradiation than did the sample of bovine fibrinogen previously studied. (auth)

16722

THE EFFECT OF RADIATION ON TISSUE DEOXYRIBONUCLEASE. N. R. Kurnick, B. W. Massey, and G. Sandeen (Veterans Administration Hospital, Long Beach, Calif. and Univ. of California, Los Angeles). Radiation Research 11, 101-14(1959) July.

In the radiosensitive spleen, bone marrow, and thymus, total-body, lethal x irradiation of the mouse produces a rapid increase in acid deoxyribonuclease activity per average cell. At the same time, a decrease in an inhibitor of serum alkaline deoxyribonuclease is demonstrable in spleen homogenates. Post-irradiation infusion of homologous bone marrow is followed by the return of the enzyme and inhibitor to normal activity as the tissues are repopulated by normal cells. The relatively radioresistant liver, which undergoes much less loss of cellularity, shows correspondingly small enzymatic change not reversible by bone marrow infusion. The radioresistant kidney shows no significant changes in either cellularity or the enzyme systems studied. (auth)

16723

INFLUENCE OF OXYGEN TENSION ON X-RAY-INDUCED CHROMOSOMAL DAMAGE IN EHRLICH ASCITES TUMOR CELLS IRRADIATED IN VITRO AND IN VIVO. Eleanor E. Deschner and L. H. Gray (Mount Vernon Hospital, Northwood, Middx, Eng.). Radiation Research 11, 115-46(1959) July.

The relation between the radiosensitivity of Ehrlich ascites tumor cells and the concentration of oxygen in the medium in which the cells are suspended at the time of irradiation was determined at various temperatures and found to conform to the relation $(\alpha-\alpha_N)/\alpha_N = (m-1)\,[O_2]/([O_2]+K)$, where α is the coefficient of abnormal anaphase production per roentgen. The constants m and K have been evaluated at different temperatures. In experiments involving the measurement of the partial pressure of oxygen in a turbulent fluid, the equilibration of ascites tumor cell suspensions with gases of low oxygen content has been studied. Tumor cell suspensions have been irradiated at room temperature under conditions in which the partial pressure of oxygen in the liquid phase is less than that in the gas phase by no more than the equivalent of 1 μM/l of dissolved oxygen. Under these conditions, it is estimated that $m = 3.10 \pm 0.27$ and $K = 5 \pm 2$ μM/l. The aberration coefficients under both anaerobic and fully aerobic conditions rise by about 30% over the temperature range 3 to 30°C, but their ratio, m, remains constant, within the limits of experimental error. The small increase with temperature of individual aberration coefficients could, at least in part, be due to a different distribution with respect to phase in the mitotic cycle of the cells irradiated at different temperatures. Measurements at 36°C are consistent with a value of K which is the same as at 18°C, but uncertainty regarding the concentration of dissolved oxygen is in this case greater, and a tem-

perature dependence of K amounting to a factor of about 2 over this temperature range is not in any way ruled out. (auth)

16724

THE UTILIZATION OF RADIOACTIVE ZINC AND MANGANESE IN AN EFFORT TO VISUALIZE THE PANCREAS. I. Meschan, James L. Quinn, Richard L. Witcofski, and Thomas A. Hosick (Bowman Gray School of Medicine, Winston-Salem, N. C.). Radiology 73, No. 1, 62-70(1959) July.

External uptake measurements over the pancreas were made at intervals of eight to twenty-four hours in 15 dogs following the administration of zinc−65 chloride and in 2 additional dogs receiving zinc−65 sulfadiazine and zinc−65 complex of 3′- or 6′-amino-fluorescein. These measurements were correlated with total organ concentration and concentration per gram weight in the liver, spleen, pancreas, and kidneys at various time intervals. Similar data are presented in relation to the uptake of manganese−54 and −52 over the pancreas in 10 dogs in two hours to ten days. These data are again correlated with per cent of total manganese recovered at similar time intervals from the liver, spleen, pancreas, and kidneys. A biphasic curve was obtained representing organ concentration in the liver and pancreas for both the zinc and the manganese. Thus far, however, this curve has not proved to be clinically useful. Concentration of zinc−65 in the pancreas is greater than that of manganese−52 or 54, and is probably more suitable for pancreatic tracer studies. Attempted isotopic scanograph studies for delineation of the pancreas were of no value with presently available apparatus. (auth)

16725

THE EFFECTS OF SPLEEN HOMOGENATE ON RADIOINDUCED BONE MARROW DAMAGE. Hans-Jürgen Thom (Universität, Heidelberg, Ger.). Strahlentherapie 109, 47-57(1959) May. (In German)

Inbreed rats received a whole-body irradiation of 800 rep 15 Mev electrons and were subsequently treated by 2 injections of 0.5 ml homogenate obtained from 150×10^6 spleen cells from healthy animals of the same breed. The first injection was given I. V. right after the irradiation. The second injection was given at the 3rd day after irradiation intraperitoneally. As compared with the untreated control animals the regeneration of the bone marrow was more rapidly, which was observed qualitative histological as well as quantitative cytological. The initial phase of damage was not changed. Already at the 3rd day after irradiation the first signs of regeneration were observed. A complete restitution was found after 14 days as compared with 21 days in the untreated control animals. The increased regeneration of the bone marrow by spleen homogenate is most significant in the erythropoesis, less marked in the myelopoesis. (auth)

16726

NEW VIEWPOINT ON STEROID THERAPY OF THE RADIATION REACTION. Karl-Heinz Kärcher (Universität, Heidelberg, Ger.). Strahlentherapie 109, 58-66(1959) May. (In German)

Despite the use of electron irradiation, ultra hard x rays, and gamma rays of the Co^{60} telecurie units, local and occasional general radiation reaction of the skin can not be avoided. The reaction is less marked however as compared with 200 kv x ray irradiation. The indications for the treatment with a new cortisone derivative, Volon, during radiotherapy are discussed. The advantages of this preparation as compared to other cortisone derivatives are pointed out. (auth)

16727

ARE THE VISIBLE MUTATIONS IN DROSOPHILA MELANOGASTER SIGNIFICANT FOR QUANTITATIVE RADIOGENETIC INVESTIGATIONS? Werner Schmid (Kantonsspitals, Zurich). Strahlentherapie 109, 79-96 (1959) May. (In German)

Applications of data on dominant and recessive viable mutations and gynadromorphs in Drosophila melanogaster in quantitative radiation genetic experiments are discussed. Data are reviewed from a number of genetic studies on Drosophila. Somatic mutations and modifications, as well as induced somatic cross-overs, are discussed. (C.H.)

16728

THE DEPENDENCE OF THE RADIATION EFFECT ON THE BODY TEMPERATURE. Hans Günter Nöller and Heribert Breitner (Universitäts-Kinderklinik, Heidelberg, Ger.). Strahlentherapie 109, 97-100(1959) May. (In German)

The influence of the body temperature on the effect of high energy radiation was studied on frogs, taking the degeneration of the lymphocytes as a comparison for the extent of radiation damage. An increase of the degeneration of the lymphocytes was found with a rise of the body temperature. No radiation damage was noted at a temperature of +2 centigrade. The effect of the radiation became manifest after a rise of the temperature, however. (auth)

16729

THE PROTECTION FROM RADIATION DAMAGE BY PARABIOTIC COMBINATION BEFORE IRRADIATION. Hans Günter Nöller and F. J. Rodriquez-Erdmann (Universitäts-Kinderklinik, Heidelberg, Ger.). Strahlentherapie 109, 101-5(1959) May. (In German)

Studies were made concerning the relation between radiation protection and time of onset of parabiosis. The degeneration of the lymphatic organs demonstrated the extent of radiation damage. It was found that parabiosis is much more effective, when its onset was prior to the irradiation of one of the animals. (auth)

16730

THE EFFECT OF PERCHLORATE ON THE REABSORPTION OF FREE IODINE BY THE THYROID. A CONTRIBUTION TO THE ACCELERATED ELIMINATION OF INCORPORATED I-131. Hans Desaga (Luisenkrankenhauses, Lindenfels/Odenwald, Ger.). Strahlentherapie 109, 106-12(1959) May. (In German)

Oral administration of perchlorate diminishes or blocks the reabsorption of iodine, which was liberated by the break down of thyroid hormone by the thyroid gland. After a total block of reabsorption of anorganic iodine by the thyroid gland, the thyroid becomes more and more depleted of iodine. Iodine from the food and liberated iodine from hormones is eliminated quickly by the kidneys. Therefore a prolonged administration of more than 1,200 mg perchlorate per day must be avoided. The block of iodine absorption by the thyroid gland is very useful for fast elimination of radioiodine from the thyroid gland. By this method the biological half-life of I^{131} can be shortened. An increased effect can be obtained by intermittent administration of perchlorate and iodine. (auth)

16731

EARLY REACTIONS ON THE BLOOD VESSELS OF THE FROG TONGUE AFTER IRRADIATION WITH BETA RAYS. Yasuro Anno and Hiroschika Oga (Universität, Tottori, Japan). Strahlentherapie 109, 144-9(1959) May. (In German)

The reactions of blood vessels of the frog tongue were studied by microscopic observation in an early stage of irradiation with P^{32} or radium. The reactions, chiefly contractions of vessels, occurred a few minutes after the beginning of irradiation. The small arteries and arterioles contracted most conspicuously and began during irradiation. The small veins contracted too, but less evidently and sometimes dilated transiently at first. Changes of vessels (i.e., contraction and dilatation) took place alternately within few hours after irradiation. Contraction in the early stage was more evident in the following order of vessels: small arteries, arterioles, venules and then capillaries. (auth)

16732

COMPLEX TREATMENT OF RADIATION SICKNESS IN BLOOD LOSS. M. Ya. Chaikovskaya, O. S. Sergel, and G. N. Elpatevskaya. Vestnik Rentgenol. i Radiol. 34, No. 3, 47-52(1959) May-June. (In Russian)

Development is reported of a combined method of treatment of radiation sickness complicated by blood loss. Experiments were carried out on dogs, irradiated 500 r. Twenty-four dogs weighing from 14 to 20 kg were under observation (18 experimental and 6 control). Various blood substitutes were used (Belenky's serum, parenterin, L-103 preparation) together with antibodies (biomycin, streptomycin) and vitamins (C, B_{12}, P, and folic acid). The combined method of therapy was effective in the treatment of radiation sickness complicated by blood loss. The course of radiation sickness in the treated animals was of a mild and average severity, as judged by the manifestations of clinical symptoms and by the duration of the disease. The morphological changes in the bone marrow and in the peripheral blood, as well as the biochemical changes in the blood serum, were of average severity and of short duration. Seventeen of the treated 18 animals survived. Only 2 of the 6 control animals remained alive. Blood substitutes made of heterogenic blood should find widespread use in the treatment of radiation sickness complicated by blood loss. Parenterin and L-103 preparation were the most effective in the treatment of radiation sickness in our experiments. Belenky's serum gave the worst results. Folic acid coupled with vitamin B_{12} promoted and accelerated the regeneration of the red blood cells in the irradiated animals. Leukogen gives a good effect in the treatment of leukopenia resulting from irradiation. (auth)

16733

CURRENT TESTS OF DOSIMETRY IN RADIATION THERAPY. A. N. Krongauz (Ministry of Public Health. U.S.S.R.). Vestnik Rentgenol. i Radiol. 34, No. 3, 52-9 (1959) May-June. (In Russian)

The biological effect taking place in the medium as the result of irradiation is determined by the absorbed irradiated energy and its micro and macro distribution in the tissue under irradiation. The quantitative evaluation of irradiation is effected by the measured dose contained in the air and expressed in roentgen units. The necessity to quantitatively evaluate absorbed irradiated energy made it imperative to introduce the so-called absorbed dose with "rad" as the unit of measurement. The latter was introduced into the new standards in addition to the roentgen units and units of new radio standards. To compare the effects of different types of ionizing radiation the absorbed irradiation activity doses are to be taken as units of evaluation. Determination of the absorbed doses is carried out by taking the dose measured in the air, and with the aid of tables for conversion roentgens into rads. Apart from absorbed doses the local effect is also greatly influenced by integral doses received by the body as a whole. (auth)

16734

A STUDY OF GENE ACTION IN ULTRAVIOLET-IRRADIATED BACTERIOPHAGE T4. David R. Krieg (Univ. of Rochester, N. Y. and Oak Ridge National Lab., Tenn.). Virology 8, 80-98(1959) May.

The action of individual r_{II}^{+} genes of bacteriophage T4 was analyzed by crosses between ultraviolet-sterilized wild-type phage and unirradiated phage mutant for the gene being investigated. Inactivation of a gene was characterized by a single-hit relation to dose, with a sensitivity of 0.10 and 0.05 per phage-lethal damage for the A and B cistrons, respectively. The presence of an r_{II}^{+} gene in the progeny of a cross was also studied. This phenomenon, called cross reactivation (CR), involves genetic duplication and recombination of irradiated phage. In some experiments doubly mutant phage was used for simultaneous analyses of two genes. The interpretation of these experiments is based on the assumption that cistrons occupy certain lengths along the phage linkage structure. A radiation-induced damage on this chromosome will inactivate a phage, but a phage's undamaged components may act in a mixed infection. A damage located anywhere within a cistron destroys its capacity for phenotypic action. Undamaged specific genetic elements may be rescued by CR. Survival of phenotype is not normally a prerequisite for CR. In these experiments, however, survival of the phenotype of the particular r_{II}^{+} gene being investigated was a necessary condition for CR. The experiments are discussed with regard to the role of phage genes in initiating infection and with regard to radiation genetics, with particular attention to cross reactivation and multiplicity reactivation of bacteriophage. (auth)

16735

ADVANCES IN BIOLOGICAL AND MEDICAL PHYSICS. VOLUME VI. Cornelius A. Tobias and John H. Lawrence, eds. New York, Academic Press Inc., 1958. 645p.

Topics discussed include concepts of ion and water transport in stomach and intestine, artificial and induced periodicity in living cells, the induction of lysogenic bacteria with x rays, gamma rays, and ultraviolet radiations, cell studies using microspectrography, the effect of ionizing radiation on tumors in experimental animals, fall-out from nuclear weapons tests, radiological contrast enhancing methods, procedures for the quantitative measurement of regional circulation in the central nervous system by the use of radioactive inert gas, the use of intense ultrasound in investigations of the central nervous system, isotopic tracers in the study of diabetes, applications of light scattering to biological systems such as desoxyribonucleic acid and the muscle proteins, and physical and chemical mechanisms in the injury of cells by ionizing radiations. (C.H.)

CHEMISTRY

General

16736 A/CONF.15/P/1261
PRODUCTION D'EAU LOURDE EN FRANCE. (Production of Heavy Water in France.) E. Roth, L. Stouls, G. Dirian, B. Lazard, and G. Nief (Commissariat à l'Énergie Atomique, Paris). 86p.

The problem of heavy water production in France is discussed, and the methods used are described. The four methods given are the H_2S-H_2O exchange method, H_2-H_2O catalytic exchange method, liquid H_2 distillation method, and NH_3-H_2 catalytic exchange method. The existence at Lacq of natural gas containing a large proportion of H_2S of high deuterium content increases the economic possibilities of the first method. (J.S.R.)

16737 AAEC/E-21
Australia. Atomic Energy Commission Research Establishment, Lucas Heights, New South Wales.
DETECTION OF TRACES OF OXYGEN IN GASES. METHYLENE BLUE METHOD. P. S. Davis. Mar. 1958. 6p.

A simple method for the detection of traces of oxygen in gas streams is described. The method is based on the color change which occurs when leuco-methylene blue is oxidized to methylene blue. Suggested uses of the method are in argon-arc welding and glove-box work where oxygen must be excluded. (auth)

16738 AAEC/E-23
Australia. Atomic Energy Commission Research Establishment, Lucas Heights, New South Wales.
ESTIMATION OF TRACES OF NICKEL IN SODIUM METAL. T. M. Florence. Feb. 1958. 6p.

A simple and sensitive method is described for the determination of traces of nickel in sodium metal. The nickel is complexed with potassium cyanide and the absorption measured spectrophotometrically at 268 mμ. Interference of iron and chromium is removed by precipitation of the hydroxides from homogeneous solution. This method should be applicable to a wide range of materials. (auth)

16739 AAEC/E-25
Australia. Atomic Energy Commission Research Establishment, Lucas Heights, New South Wales.
THE THORIUM-APANS COMPLEX. A SPECTROPHOTOMETRIC STUDY. A. R. Palmer. Feb. 1958. 9p.

The complex formed from thorium and APANS [1-(o-arsonophenylazo)-2-naphthol-3:6-disulfonic acid] was studied by the spectrophotometric method and shown to contain thorium and reagent in the ratio 1:2. The apparent stability constant of this complex was measured as $1.4 \pm 0.1 \times 10^{10}$. (auth)

16740 AAEC/E-26
Australia. Atomic Energy Commission Research Establishment, Lucas Heights, New South Wales.
DILUENTS FOR THE SOLVENT EXTRACTION OF THORIUM USING TRIBUTYL PHOSPHATE GENERAL CONSIDERATION AND THE THIRD PHASE PROBLEM. M. S. Farrell and J. D. Goldrick. Sept. 1958. 19p.

An examination of three possible diluents available from Australian sources of supply, has shown that "odorless mineral spirits" from Vacuum Oil Co. Pty. Ltd., is the purest in alkane content and is the most suitable of the three for use with TBP for the chemical processing of irradiated fuel, for example by the Thorex process. A small quantity of sec-octyl alcohol will suppress third phase formation but further work is required to ensure that its use is otherwise compatible with the process. (auth)

16741 AECU-4212
Los Alamos Scientific Lab., N. Mex.
SEPARATION OF RARE EARTHS AT AMALGAM CATHODES. III. THE SEPARATION OF SAMARIUM FROM GADOLINIUM. E. I. Onstott. [1955]. 14p. Contract [W-7405-eng-36]. $3.30(ph), $2.40(mf) OTS.

Samarium is efficiently separated from gadolinium by electrolysis of the citrate complexes at a lithium amalgam cathode. Under optimum conditions, about 99% of the samarium is electrolyzed while less than 10% of the gadolinium is electrolyzed. There is also a preferential electrolysis of gadolinium over dyprosium. Data were obtained which show how the electrolysis is dependent on the cathode potential and the pH of the electrolyte. (auth)

16742 AERE-AM-21
United Kingdom Atomic Energy Authority. Research Group. Chemistry Div., Woolwich Outstation, England.
THE DETERMINATION OF COPPER IN BERYLLIUM METAL. J. Walkden. May 1959. 5p. $0.16(BIS).

The copper is extracted as the diethyl dithiocarbamate complex by chloroform from an ammoniacal citrate solution. Interference is suppressed by the addition of ethylenediamine tetraacetic acid. The copper is determined absorptiometrically. (auth)

16743 AERE-AM-24
United Kingdom Atomic Energy Authority. Research Group. Chemistry Div., Woolwich Outstation, England.
THE DETERMINATION OF GERMANIUM IN ZIRCONIUM. E. Booth and M. Bakes. May 1959. 6p. $0.16(BIS).

Germanium chloride is formed and is separated by extraction into carbon tetrachloride. The germanium chloride is back extracted into aqueous solution and the germanium determined absorptiometrically using phenyl fluorone (9-phenyl-2:3:7 trihydroxy-6-fluorone). The method as written is suitable for the determination of 5 to 50 μg of germanium. Except in the lowest part of the range the error should not exceed 5%. (auth)

16744 AERE-AM-26
United Kingdom Atomic Energy Authority. Research Group. Chemistry Div., Woolwich Outstation, England.
THE DETERMINATION OF MOLYBDENUM IN FUSED MIXTURES OF SODIUM, ZIRCONIUM AND URANIUM FLUORIDES. A. Parker. May 1959. 6p. $0.16 (BIS).

The sample is fused with potassium pyrosulfate and the resulting melt dissolved in water. Molybdenum is determined by extraction of the dithiol complex into amyl acetate and measurement of the absorbancy of the extract at 685 mμ. The method covers the range 1 to 50 μg of molybdenum. The error except in the lowest ranges should not exceed ± 5%. (auth)

16745 AERE-AM-27
United Kingdom Atomic Energy Authority. Research Group. Chemistry Div., Woolwich Outstation, England.
THE DETERMINATION OF URANIUM IN BISMUTH

BASE ALLOYS. F. E. Wild. May 1959. 9p. $0.35 (BIS).

The uranium is determined polarographically, using an acid tartrate medium, on the residue obtained after the bismuth has been removed by volatilization as the bromide. Depending on the amounts of other elements in the residue, the determination is carried out directly or after a further separation of uranium nitrate by elution with ether from a cellulose column. On a sample weight of 1 g of bismuth, uranium contents of 10 ppm may be determined with accuracy, and lower amounts detected. At a level of 50 ppm the coefficient of variation is 1.5%. (auth)

16746 AERE-AM-28

United Kingdom Atomic Energy Authority. Research Group. Chemistry Div., Woolwich Outstation, England.

THE DETERMINATION OF NIOBIUM IN BISMUTH BASE ALLOYS. F. E. Wild. May 1959. 6p. $0.25 (BIS).

The method is based on the reaction of niobium with thiocyanic acid in 4 M hydrochloric acid and 0.5 M tartaric acid medium, after the removal of bismuth as the bromide by volatilization. The complex is extracted with ether, and the solution is stabilized with acetone. Its absorption is measured at 385 mμ in a spectrophotometer. At a level of 4 ppm, the coefficient of variation is better than 3%. (auth)

16747 AERE-AM-30

United Kingdom Atomic Energy Authority. Research Group. Chemistry Div., Woolwich Outstation, England.

THE VOLUMETRIC DETERMINATION OF BERYLLIUM IN LOW GRADE ORES. C. G. Wallace. May 1959. 9p. $0.25(BIS).

The ore is decomposed by fusion with excess alkali metal carbonate. Beryllium oxide is extracted with aqueous ammonium fluoride and the fluoberyllate converted to oxide. Extracted alumina is removed by a second alkali metal carbonate fusion. The beryllium oxide content is determined volumetrically by reaction with alkali metal fluoride and titration of the liberated alkali. Scandium, if present above 10 per cent of the BeO content, is removed by precipitation with silicofluoride. The procedure should be applicable to a lower limit of about 0.01 per cent. At the level of 0.3 per cent BeO, the coefficient of variation of the results is better than 5 per cent. (auth)

16748 AERE-AM-31

United Kingdom Atomic Energy Authority. Research Group. Chemistry Div., Woolwich Outstation, England.

THE DETERMINATION OF FREE CARBON IN BERYLLIUM METAL. J. Walkden. May 1959. 4p. $0.16 (BIS).

The sample is dissolved in hydrochloric acid and filtered through an asbestos pad. The pad, holding the free carbon, is ignited in a stream of oxygen, and the resulting carbon dioxide is absorbed in Carbest and weighed. The method is suitable for free carbon contents down to 0.005 per cent. (auth)

16749 AERE-C/R-2766

United Kingdom Atomic Energy Authority. Research Group. Atomic Energy Research Establishment, Harwell, Berks, England.

THE EMISSION AND ABSORPTION SPECTRA OF URANIUM EXCITED IN A KING FURNACE. L. Bovey and H. Wise. Dec. 1958. 201p. $3.64(BIS).

Work carried out intermittently over the past four years on the King furnace emission and absorption spectra of uranium is summarized, and a list containing 3554 emission and 2319 absorption lines (together with arc, furnace, and spark intensities and assignment when known) is included. A discussion on the application of the results to the term analysis of uranium and plutonium is given. (auth)

16750 ANL-6002

Argonne National Lab., Lemont, Ill.

THE FLUORINATION OF METALLIC TITANIUM. M. J. Steindler, D. V. Steidl, and R. K. Steunenberg. June 1959. 6p. Contract W-31-109-eng-38. $0.50 (OTS).

Metallic titanium was fluorinated by elemental fluorine at 100, 200, and 300°C and at partial pressures of fluorine of 0.25, 0.50, 0.75, and 1.0 atmosphere. The effect of flow rates was studied briefly. The activation energy for the reaction is approximately 25.6 kcal/mole. (auth)

16751 BM-RI-5485

Bureau of Mines.

LOW-TEMPERATURE HEAT CAPACITIES AND ENTROPIES AT 298.15°K. OF CERIUM MONOSULFIDE, CERIUM SESQUISULFIDE AND THORIUM DISULFIDE. E. G. King and W. W. Weller. Jan. 1959. 8p.

The heat capacity between 51 and 298°K and entropy values at 298.15°K for CeS, Ce_2S_3, and ThS were determined. The entropy values with literature results for the heats of formation were used to obtain free energies of formation at 298.15°K. Data are tabulated. (J.R.D.)

16752 CEA-834

France. Commissariat à l'Énergie Atomique, Paris.

RÉALISATION D'UN ÉCHANTILLONNEUR A SODIUM LIQUIDE. (Liquid Sodium Sampler.) H. Chevilliard. Feb. 1959. 5p.

A liquid metal sampler which permits the extraction of a given quantity of metal and its introduction into a movable container or analyzer without pollution by atmospheric oxygen is described. The apparatus is constructed of stainless steel. During sampling the pressure does not exceed 5×10^{-5} mm of mercury, and it is possible to remove only a drop of the metal. (J.S.R.)

16753 CF-58-1-101

Oak Ridge National Lab., Tenn.

SUMMARY OF THE PROPERTIES OF NIOBIUM. C. K. McGlothlan. Jan. 6, 1958. 21p. Contract [W-7405-eng-26]. $4.80(ph), $2.70(mf) OTS.

A literature survey of the atomic, thermal, electrical, and mechanical properties and general information of niobium is reported. (J.E.D.)

16754 CF-58-1-130

Oak Ridge National Lab., Tenn.

SUMMARY OF THE PROPERTIES OF LITHIUM. C. K. McGlothlan. Jan. 3, 1958. 20p. Contract [W-7405-eng-26]. $3.30(ph), $2.40(mf) OTS.

A literature survey on the properties of Li is presented. Also, general information is given concerning moving and storage, fire control, and information on circulating systems in which it may be used. (J.R.D.)

16755 CF-59-4-83

Oak Ridge National Lab., Tenn.

FLOODING CHARACTERISTICS OF ¼-in. FLUORO-

THENE RASCHIG RINGS. R. L. Boles and S. H. Stainker. Apr. 27, 1959. 14p. Contract [W-7405-eng-26]. $3.30(ph), $2.40(mf) OTS.

The flooding characteristics of fluorothene Raschig rings at low liquid rates with the existing literature data on carbon rings are compared. Visual observations of flooding in the air–water system were correlated with pressure drop using a 3-in. i.d. glass column having an 18-in. long fluorothene Raschig ring packed section. A comparison of extrapolated literature data with these experimental data indicates the gas flow rates required to flood fluorothene packing are slightly higher than for carbon packing. At a liquid flow rate of 537 lbs/hr-ft^2, fluorothene rings flooded at a gas velocity of 842 lbs/hr-ft^2 whereas carbon rings are reported to flood at a gas velocity of approximately 755 lbs/hr-ft^2. (auth)

16756 CF-59-5-93

Oak Ridge National Lab., Tenn.

THE DEVELOPMENT OF A FLUIDIZED BED REACTOR FOR THE FLUOROX PROCESS: UNIT OPERATIONS MONTHLY STATUS REPORTS FOR THE PERIOD NOVEMBER 1958 THROUGH MAY 1959. J. C. Bresee, C. D. Scott, and R. W. Horton. May 26, 1959. 42p. Contract [W-7405-eng-26]. $7.80(ph), $3.30(mf) OTS.

Results of four experimental runs in the Fluorox fluidized bed reactor system are reported. The engineering feasibility of UF_6 production from UF_4 by use of dry air of O_2, $2UF_4 + O_2 = UF_6 + UO_2F_2$, in an Inconel fluidized bed reactor at 800 to 850°C was demonstrated in two experimental tests in which greater than 90% of the theoretical amount of UF_6 was collected or measured. Two runs made with crude UF_4 (produced from unpurified mill concentrate) as the feed material, showed that UF_6 could be produced at 700 to 725°C but corrosion on Inconel was prohibitive. (auth)

16757 CI-R-15

Gt. Brit. Springfields Works, Springfields, Lancs, England.

THE REACTION BETWEEN HYDROGEN PEROXIDE AND SOLUTIONS OF PURE URANYL SALTS. PART I: THE INTERACTION OF HYDROGEN PEROXIDE AND URANYL NITRATE. J. R. Sanderson, H. E. Dibben, and H. Mason. May 1951. 18p. (SCS-R-163).

Potentiometric titration and other experiments indicate that the mechanism of the interaction in solution of pure uranyl nitrate and hydrogen peroxide is governed by the pH and the concentration of the reactants. In absence of free nitric acid the reaction proceeds to completion, as it does when the pH is raised, although hydrolysis then occurs also; in the presence of free nitric acid reaction reversal, i.e., dissolution of uranium peroxide, takes place, thus reducing the precipitation efficiency, but excess hydrogen peroxide, aiding the forward reaction, reduces this effect. At concentrations of 0.05 and 0.005 M the optimum precipitation pH appears to be that of a solution containing uranyl and nitrate ions in stoichiometric proportions, at which point the reaction is almost quantitative and the rate of settling of the precipitate is the highest. The progressive addition of ammonium hydroxide to neutral uranyl nitrate in solution results in hydrolysis without precipitation until a compound, perhaps $[(UO_3)_2UO_2OH] + NO_3$, exists in the solution which irreversibly slowly hydrolyses with formation of a precipitate which is possibly the trimer of uranyl hydroxide. Further addition of ammonium hydroxide results in the formation of an insoluble uranate, possible $(UO_3)OH \cdot NH_4$. (auth)

16758 CNI-16

Italy. Comitato Nazionale per le Ricerche Nucleari, Milan.

DISSOLUTION RATE OF URANIUM IN LIQUID METALS. G. J. Segre. June 1959. 11p.

At 356°C the rate of dissolution of uranium in boiling mercury saturated with uranium decreases with increasing contact time, presumably due to the formation of a mercurish film. Initial rates as high as 30 mg/cm^{-2}/hr^{-1} and final rates as low as 0.5 mg/cm^{-2}/hr^{-1} were observed. In uranium-saturated molten bismuth at 400°C the corrosion rate is 28 mg/cm^{-2}/hr^{-1} and is essentially independent of exposure time. (auth)

16759 IGO-AM/S-17

United Kingdom Atomic Energy Authority. Industrial Group. Springfields Works, Springfields, Lancs, England.

DETERMINATION OF COMBINED NITROGEN IN ZIRCONIUM METAL. Apr. 20, 1956. 9p.

The metal is dissolved in hot 9 M sulfuric acid assisted by the addition of hydrofluoric acid. The ammonia separated by distillation from alkaline solution is determined absorptiometrically using either sodium phenate/sodium hypochlorite reagent for samples containing between 5 and 90 ppm combined nitrogen or Nessler's reagent for samples containing between 90 ppm and 2% combined nitrogen. The method is applicable to "pure" zirconium metal containing between 5 ppm and 2% w/w combined nitrogen. In the 5 to 90 ppm range, results are quantitative with a coefficient of variation of about ±3%. At the 400 ppm level, results show a negative bias of about 5% with a coefficient of variation of about ±3%. (auth)

16760 IGO-AM/S-132

United Kingdom Atomic Energy Authority. Industrial Group. Springfields Works, Springfields, Lancs, England.

THE ABSORPTIOMETRIC DETERMINATION OF MANGANESE IN BERYLLIUM METAL. Mar. 3, 1959. 5p.

Beryllium is dissolved in sulfuric acid. Phosphoric acid is added to a suitable aliquot and the manganese oxidized to the pink permanganic state using potassium periodate. The manganese is determined spectrophotometrically. The method is suitable for the determination over a range from 25 to 500 μg. The precision is equivalent to ± 8 μg manganese at the 170 μg level. (J.E.D.)

16761 IGO-AM/S-163

United Kingdom Atomic Energy Authority. Industrial Group. Springfields Works, Springfields, Lancs, England.

THE SPECTROGRAPHIC DETERMINATION OF LITHIUM IN MAGNESIUM METAL. Mar. 1, 1959. 6p.

The sample is dissolved in nitric acid, and the solution is examined for lithium by the Lundegardh technique. The method is applicable to samples of magnesium in the form of raspings or turnings over a concentration range 2 to 20 ppm of lithium. (auth)

16762 IGO-AM/S-202

United Kingdom Atomic Energy Authority. Industrial Group. Springfields Works, Springfields, Lancs, England.

THE GRAVIMETRIC DETERMINATION OF MOLYBDENUM IN URANIUM–MOLYBDENUM ALLOYS. Mar. 3, 1959. 5p.

The sample is dissolved in nitric and hydrochloric acids. After heating the solution with sulfuric acid, molybdenum is precipitated as the benzoin-oxime complex which is ignited to molybdic oxide. This is dissolved in ammonia, and the molybdenum is precipitated and weighed as lead molybdate. (auth)

16763 IGR-132(RD/CA)

United Kingdom Atomic Energy Authority. Industrial Group. Capenhurst Works, Capenhurst, Ches., England.

THE ANALYSIS OF CORROSIVE GASES BY MASS SPECTROMETRY. P. G. Bentley, J. R. Fothergill, and A. N. Hamer. Apr. 15, 1959. 19p.

The extent to which mass spectrometry can be usefully employed in the analysis of corrosive gas mixtures is discussed. Mixtures containing hydrogen fluoride and chlorine trifluoride are particularly considered. Details are given of the instrumental modifications and the operational procedures which are necessary if the gases are to be handled successfully. The problems of their adsorption and reaction at surfaces are discussed at some length. Limits of detection are normally about 1% of chlorine trifluoride, 0.1% of other corrosive gases, and 0.01% of noncorrosive gases; these figures, depend on the nature of the other components in the mixture. (auth)

16764 IGR-TN/W-318

United Kingdom Atomic Energy Authority. Industrial Group. Windscale Works, Sellafield, Cumb., England.

NOTES ON ZIRCONIUM CHEMISTRY IN NITRIC ACID SOLUTION AND ITS EXTRACTION INTO T.B.P./O.K. D. Smithies. Apr. 13, 1956. 11p. (IGC-B205WP/P-1).

Previous work on the chemistry of zirconium in aqueous solution with reference to the species present and their extractability into TBP/OK is reviewed. A summary of methods that can be used to study equilibria in solution is also given. (auth)

16765 KAPL-M-LMO-4

Knolls Atomic Power Lab., Schenectady, N. Y.

X-RAY DIFFRACTION ANALYSIS OF BORON IN BORON CARBIDE. L. M. Osika. May 26, 1959. 8p. Contract W-31-109-Eng-52. $1.80(ph), $1.80 (mf) OTS.

By applying the relationships between lattice parameters and composition in the solid solution range, a method was presented to analyze boron in boron carbide. The purpose was to establish a means of determining the boron composition in a boron carbide solid solution in the presence of excess carbon or boron. The different unit-cell dimensions sometimes reported for a given solid mixture are usually attributed to the existence of solid solutions. If the crystal lattice parameters vary linearly with composition, a curve can be constructed to determine composition from lattice parameter measurements. Toward this end four samples of boron carbide of known nominal composition were selected. For each sample precision lattice parameter measurements and chemical analyses of boron and carbon content were obtained to establish relationship between lattice parameters and boron composition. (auth)

16766 NBL-153

New Brunswick Lab., AEC, N. J.

SEMIANNUAL PROGRESS REPORT FOR THE PERIOD JULY 1958 THROUGH DECEMBER 1958. C. J. Rodden. June 1959. 65p. $1.75(OTS).

The high precision method for the determination of U is presented in which electrolytic reduction and potentiometric titration with certain electrode pairs are used. Traces of Br in hydrolyzed UF_6 samples, along with added carriers, are precipitated with $AgNO_3$. The silver halides are dissolved in a solution of NaCl, and the bromide is oxidized with chloramine T. The resulting bromine converts phenol red to brom-phenol blue which is measured spectrophotometrically. The methanol-bromine dissolution method for the spectrophotometric determination of B in Zircaloy was further developed to analyze Zr and Be. A set of reference samples containing from 15 to 93% U^{235} was prepared for use in the determination of U^{235} by gamma-ray scintillation spectrometry using a single-channel pulse-height analyzer. A six-position Frisch grid ionization chamber was constructed. The alpha spectra of U^{234}, U^{236}, and Po^{210} were examined with the use of a single-channel pulse-height analyzer. Thermogravimetric analyses were made of uranium oxide from four different sources. A method is given for sampling UF_6. (For preceding period see NBL-147.) (W.L.H.)

16767 NP-7696

Rio de Janeiro. Centro Brasileiro de Pesquisas Físicas.

DETERMINATION OF THE STABILITY CONSTANTS OF THORIUM NITRATE COMPLEXES WITH ANION-EXCHANGE RESINS. J. Danon. 1959. 16p. (Notas de Física Vol. V, No. 6.)

The determination of successive stability constants of thorium nitrate complexes by solvent extraction methods was investigated. (J.E.D.)

16768 NYO-3191

Syracuse Univ., N. Y.

[PART] A. COPRECIPITATION FROM HOMOGENEOUS SOLUTION. [PART] B. ANALYTICAL CHEMISTRY OF THORIUM. [PROGRESS REPORT] FOR PERIOD SEPTEMBER 1, 1952 TO JUNE 2, 1953. Louis Gordon. June 1, 1953. 52p. Contract AT(30-1)-1213. $9.30(ph), $3.60(mf) OTS.

An account of studies on coprecipitation from homogeneous solutions is presented. Basic Stannic Sulfate: In solutions initially 10^{-3} M in tin(IV) and 10^{-3} M in manganese(II), the extent of coprecipitation of the latter on basic stannic sulfate precipitated by the urea method is increased with increasing rate of precipitation. However, at a given rate (86°C) much of the foreign ion is coprecipitated during the separation of the initial 25% of the total carrier present. Only a negligible amount of the foreign ion is then further coprecipitated as the remainder of the carrier is precipitated up to the point where approximately 99.9% of the total initially present has been separated. After complete precipitation has occurred the adsorption of foreign ions by the carrier becomes appreciable and causes a sharp rise in the total amount of coprecipitation. With a very slow rate of precipitation (76°C), where the basic stannic sulfate is precipitated over a period of about 30 hours, there is a complete elimination of the initial coprecipitation effect. After about 50% of the carrier has been precipitated, there occurs a small and steadily increasing amount of coprecipitation until most of the tin has been separated at which point there is again, as before, a sharp rise in the total amount of coprecipitation. Barium Sulfate: A study was made of the distribution coefficient of Sr with barium sulfate as carrier. Fractions of the latter were precipitated from homogeneous solution by the hydrolysis of dimethyl sulfate

in 20% methyl alcohol at 83°C. The distribution is logarithmic in accordance with the formulation of Doerner and Hoskins. Ferric Iodate: A method was devised for the precipitation of ferric iodate from homogeneous solution. Precipitation is effected with ethylene diacetate and sodium periodate. Hydrolysis of the ester produces ethylene glycol which then reduces periodate, thus precipitating ferric iodate in a dense and readily filterable form suitable for coprecipitation studies. Silver Chloride: A study was initiated to determine the distribution of thallium(I) between silver chloride and the solution in which precipitation is effected. Thorium Iodate: Thorium iodate may be precipitated from homogeneous solution in a dense and granular form with iodate produced by the reduction of periodate with ethylene glycol; the latter is slowly produced by the hydrolysis of β-hydroxyethyl acetate. The precipitate thus obtained is easily washed and filtered. Thorium Oxalate: As part of a study of coprecipitation with thorium oxalate it becomes necessary to determine the solubility losses of thorium oxalate due to the presence of ammonium salts. Of the several methods tested the procedure by Ewing and Banks [Anal. Chem. 20, 233 (1948)] gives satisfactory results. However, if rare earths are present to act as carriers for any residual thorium in solution, ammonium salts do not interfere. Also included are abstracts of reports on precipitation of iodates, determination of tin, and coprecipitation from homogeneous solution. (For preceding period see NYO-3186.) (J.R.D.)

16769 RDB(C)-8088

Gt. Brit. Culcheth Labs., Culcheth, Lancs, England.
AN INVESTIGATION OF THE VACUUM EVAPORATION OF ZINC FROM SOLID SOLUTIONS. J. S. Broadley and E. Bevitt. Mar. 1, 1954. 43p.

The loss of zinc from solid solution in copper and nickel by evaporation in vacuo results both in the reduction of the external dimensions of the alloy specimen and in the production of internal porosity. The size of these pores which are without interconnection increases with increasing zinc loss. Further heating after dezincification causes a reduction in the pore size. In the early stages of dezincification the pores appear to be bounded by specific lattice planes. It has been shown that these planes are probably the {111} planes, which are the usual slip planes of the lattice. The diffusion coefficients obtained for zinc in α brass agree in value with those obtained by other methods. A value for the diffusion coefficient of zinc in α nickel zinc solid solution has also been obtained. The activation energies estimated from these diffusion coefficients are of the order expected and are in fair agreement with values previously recorded. (auth)

16770 RDB(C)/TN-92

United Kingdom Atomic Energy Authority. Industrial Group. Culcheth Labs., Culcheth, Lancs, England.
REDUCTION OF NIOBIUM COMPOUNDS BY METAL REDUCTANTS. W. E. Dennis and A. F. Adamson. Aug. 18, 1954. 11p.

The reduction of niobium pentoxide and niobium trichloride by calcium and magnesium has been studied. The available niobium compounds varied both in origin and composition, and thus a systematic study of the process was not possible. However, the results obtained indicate that ductile niobium can be produced from pure niobium pentoxide or niobium trichloride by calcium reduction. (auth)

16771 RDB(W)/TN-55

Gt. Brit. Windscale Works, Sellafield, Cumb., England.
ANALYTICAL METHODS FOR THE DETERMINATION OF IODINE 131 IN BIOLOGICAL MATERIAL. D. H. Bratt. Mar. 9, 1953. 16p.

Three methods of extracting iodine from biological materials have been modified for the detection and measurement of iodine-131 contamination in animals and plants. Using these methods, activities down to 2×10^{-7} microcuries of iodine-131 per gram of fresh sample can be determined if sufficient sample is used. Thus less than a tenth of the drinking water maximum permissible level of 3×10^{-6} μc iodine-131 per gram can be detected satisfactorily. Other maximum permissible concentrations of interest in monitoring for iodine-131 are well within the sensitivity of the methods. (auth)

16772 SCS-M-8A

Gt. Brit. Springfields Works, Springfields, Lancs, England.
THE DETERMINATION OF WATER IN URANIUM TETRAFLUORIDE. July 6, 1953. 7p.

The uranium tetrafluoride is ground, suspended in methanol previously titrated with Karl Fischer reagent, and titrated with Fischer reagent to an electrometric endpoint, the titration being carried out slowly to ensure complete extraction of water. (auth)

16773 SCS-M-36A

Gt. Brit. Springfields Works, Springfields, Lancs, England.
THE DETERMINATION OF SILICON IN URANOUS FLUORIDE. Aug. 17, 1953. 6p.

The uranous fluoride is dissolved in aluminum sulfate and nitric acid. After formation of silico molybdic acid and reduction to molybdenum blue, the silicon is determined absorptiometrically. Any insoluble residue is filtered off and fused with caustic soda. The melt is dissolved in water and the silicon determined absorptiometrically as above. The method is suitable for a concentration of 10 to 120 ppm in relation to the uranium content. (auth)

16774 SCS-M-52A

Gt. Brit. Springfields Works, Springfields, Lancs, England.
THE DETERMINATION OF NICKEL IN URANIUM TETRAFLUORIDE. Sept. 29, 1950. 4p.

The sample is dissolved in nitric and hydrochloric acids, and the excess acids are removed by evaporation to dryness. The residue is dissolved in water, and ammonium citrate solution added followed by bromine water and ammonia solution. Dimethyl glyoxime solution is added and the nickel concentration determined by measuring the absorption of the complex formed. (auth)

16775 SCS-M-54

Gt. Brit. Springfields Works, Springfields, Lancs, England.
THE DETERMINATION OF COPPER IN URANIUM METAL. Jan. 15, 1950. 5p.

Copper is separated by chloroform extraction of the cupferron complex, and after removal of iron it is determined absorptiometrically as the diethyldithiocarbamate. (auth)

16776 SCS-M-63A

Gt. Brit. Springfields Works, Springfields, Lancs, England.

THE DETERMINATION OF MAJOR CONSTITUENTS OTHER THAN URANIUM IN PITCHBLENDE ORE. Feb. 3, 1954. 21p.

Methods for the determination of lead, iron, aluminum, calcium, and magnesium follow classical procedures after extraction of the uranium using ether. Arsenic is determined volumetrically using iodine, cobalt potentiometrically using ferricyanide, and manganese volumetrically after oxidation to permanganate. Molybdenum, nickel, phosphorus, and silicon are determined gravimetrically by adaptation of classical procedures following separations from the main bulk of uranium where necessary. The methods were designed specifically for the analysis of pitchblende but they may, with some modification, be used as the basis for the analysis of other ores or concentrates. (auth)

16777 SCS-M-87

Gt. Brit. Springfields Works, Springfields, Lancs, England.

THE DETERMINATION OF FLUORINE IN URANIUM POWDER AND OXIDE. Mar. 4, 1954. 6p.

The sample is dissolved in a mixture of perchloric acid and hydrogen peroxide. The fluorine is distilled from the resulting solution into sodium hydroxide solution. Hydroxylamine hydrochloride is added to the distillate to destroy any peroxide which may have distilled undecomposed. The pH of an aliquot of the distillate is adjusted to 3.0 using a pH meter, and the fluorine is titrated with standard thorium nitrate solution in the presence of Chrome Azurol S indicator. The method is suitable for a concentration range of 5 to 75 ppm. (auth)

16778 SCS-M-104

Gt. Brit. Springfields Works, Springfields, Lancs, England.

THE DETERMINATION OF LOW NITRIC ACID CONCENTRATION IN URANYL NITRATE HEXAHYDRATE (IMMEDIATELY PRIOR TO ETHER EXTRACTION). Nov. 3, 1948. 3p.

The acid concentration is determined by a potentiometric titration of free nitric acid with normal sodium hydroxide solution to pH 1.48. The method is suitable for a concentration of 0.3 to 0.5% free nitric acid. (auth)

16779 SCS-M-129

Gt. Brit. Springfields Works, Springfields, Lancs, England.

THE DETERMINATION OF FREE NITRIC ACID IN URANYL NITRATE SOLUTIONS. July 25, 1950. 6p.

The uranyl ion is complexed with potassium oxalate to form potassium uranyl oxalate which is stable to hydroxyl ions. Excess potassium oxalate then reacts with the free nitric acid to form potassium hydrogen oxalate, which in turn reacts with ammonium benzoate to liberate free benzoic acid. The benzoic acid is extracted by shaking with chloroform until equilibrium is obtained when the lower organic layer is run off and titrated with alcoholic caustic potash to the phenolphthalein end point. Owing to partition characteristics of the chloroform/benzoic acid/potassium oxalate system, extraction is not complete, and a calibration curve must be used to evaluate results. Concentration range is 0 to 6% nitric acid. (auth)

16780 SCS-M-304A

Gt. Brit. Ministry of Supply. Chemical Inspectorate, London.

THE DETERMINATION OF TOTAL SOLIDS AND SPECTROGRAPHIC DETERMINATION (CONCENTRATION) OF GENERAL METALS AND RARE EARTHS IN RIVER WATERS. May 18, 1950. 3p.

The sample is evaporated to dryness, and the total solids are weighed after drying at 120 to 130°C. The residue is treated with sulfuric acid and sucrose after the addition of iron if necessary. The residue is ignited, and the oxides are examined spectrographically. (auth)

16781 SCS-M-308

Gt. Brit. Springfields Works, Springfields, Lancs, England.

SPECTROGRAPHIC DETERMINATION OF RARE EARTHS IN CALCIUM FLUORIDE (PREPARATION). Sept. 14, 1949. 21p.

Calcium fluoride is decomposed by perchloric acid, and rare earths are precipitated on ferric hydroxide by addition of ammonia and finally precipitated by ammonia in the presence of a standard amount of iron. The oxides obtained by ignition are examined spectrographically. The method is based on normal spectrochemical procedure. (auth)

16782 SCS-M-310

Gt. Brit. Springfields Works, Springfields, Lancs, England.

THE SPECTROGRAPHIC DETERMINATION OF LITHIUM, SODIUM AND POTASSIUM IN RIVER WATER (PREPARATION). Sept. 14, 1949. 3p.

The sample is evaporated to dryness and the residue dissolved in hydrochloric acid. The solution is diluted with water, filtered, and examined spectrographically by the Lundegardh technique. (J.E.D.)

16783 SCS-M-314

Gt. Brit. Springfields Works, Springfields, Lancs, England.

THE SPECTROGRAPHIC DETERMINATION OF TRACE AMOUNTS OF INDIUM IN URANIUM METAL. Apr. 11, 1950. 13p.

A solution of indium, at a controlled pH, is extracted with dithizone in the presence of ammonium citrate and cupferron. The dithizonates are absorbed on a column of activated alumina and the indium-containing portion of the column mixed with an internal standard/carrier mixture and spectrographed by a carrier distillation technique. Evaluation is by means of a microphotometer, using an internal standard. The method is suitable for indium concentrations in the range 0.01 to 0.1 ppm. (auth)

16784 SCS-M-315

Gt. Brit. Springfields Works, Springfields, Lancs, England.

THE SPECTROGRAPHIC DETERMINATION OF CADMIUM IN MISCELLANEOUS NON-URANIC MATERIALS. May 9, 1950. 11p.

A solution of the sample is suitably treated so that on rendering it ammoniacal the cadmium may be quantitatively extracted by a solution of dithizone in carbon tetrachloride. The dithizone extract is passed through a small column of activated alumina. The first centimeter of the column is isolated and mixed with an internal standard carrier mixture and spectrographed by a modified carrier-distillation technique. The cadmium content of the sample is found by measurement of the density of the cadmium line 2288.0 A and comparison with the internal standard arsenic line 2288.1 A. Similar measurements are made for a series of cadmium standards photographed on the same plate. (auth)

16785 SCS-M-339
Gt. Brit. Springfields Works, Springfields, Lancs, England.
THE SPECTROGRAPHIC DETERMINATION OF CALCIUM IN MAGNOX C USING THE LUNDEGARDH TECHNIQUE. Jan. 31, 1955. 7p.

The metal is dissolved by hydrochloric acid and cobalt added as an internal standard. The solution is examined by the Lundegardh flame technique and the resulting spectrograms evaluated by plate calibration technique. The method is suitable for samples containing from 0.003 to 0.05% calcium, with a precision of ± 20% at the 0.005% level and ± 10% at the 0.02% level. (auth)

16786 SCS-M-357
Gt. Brit. Springfields Works, Springfields, Lancs, England.
THE SPECTROGRAPHIC DETERMINATION OF RARE EARTHS IN IRON FLUX CONCENTRATES USING A JARRELL-ASH 21-foot GRATING SPECTROGRAPH. Sept. 18, 1950. 18p.

The concentrate from the chemical separation of the rare earths is spectrographed using a Jarrell-Ash grating spectrograph. The densities of the spectrum lines due to the rare earths are compared with those of iron added as internal standard and the concentration values obtained from a table of line-pair equalities. (auth)

16787 SCS-M-361
Gt. Brit. Springfields Works, Springfields, Lancs, England.
THE SPECTROGRAPHIC DETERMINATION OF MAGNESIUM IN URANIUM POWDER USING THE LUNDEGARDH TECHNIQUE. Sept. 11, 1953. 6p.

The metal powder is converted to uranyl nitrate hexahydrate and dissolved in water. The solution is examined by the Lundegardh flame technique, and the spectrograms are evaluated microphotometrically. The method is suitable for samples containing 200 to 5000 ppm magnesium, and has a precision of ± 10% within the limits stated. (auth)

16788 SCS-M-363
United Kingdom Atomic Energy Authority. Industrial Group. Springfields Works, Springfields, Lancs, England.
THE DETERMINATION OF THE MIXED OXIDES OF NIOBIUM AND TANTALUM IN C.R.L. "SHORT COLUMN" ELUATES. Apr. 20, 1955. 4p.

Both elements are precipitated as tannates from the eluate after it has been made alkaline with ammonia. After washing and drying, the precipitate is ignited to give the total of mixed oxides $Ta_2O_5 + Nb_2O_5$. The method is suitable for 70 to 300 mg niobium and 10 to 100 mg tantalum in admixture. (auth)

16789 SCS-M-367
Gt. Brit. Springfields Works, Springfields, Lancs, England.
THE DETERMINATION OF MAGNESIUM METAL AND URANIUM METAL IN SLAGS. Aug. 16, 1955. 6p.

The magnesium metal and uranium metal are determined by measuring the volume of hydrogen evolved after the addition, consecutively, of acetic acid and hydrochloric acid. The method is applicable to samples containing 0.05 to 0.3% magnesium metal and 0.25 to 1.5% uranium metal using a small apparatus and 0.3 to 5.0% magnesium metal and 1.5 to 25% uranium metal using a large apparatus. (auth)

16790 SCS-M-404
United Kingdom Atomic Energy Authority. Industrial Group. Springfields Works, Springfields, Lancs, England.
THE DETERMINATION OF CHLORIDE IN NIOBIUM METAL. Aug. 19, 1955. 5p.

An alkali-fusion of the sample is dissolved in nitric acid, with fluoride added to prevent precipitation of niobium. The solution is titrated with standard silver nitrate, the end-point being detected electrometrically. The method is capable of the determination of chlorides from 100 μg upwards with a precision of approximately ± 10 μg. The method is essentially based on general electrochemical practice, but the end-point indication obviates any graphical errors and has a high sensitivity. (auth)

16791 SCS-M-408
United Kingdom Atomic Energy Authority. Industrial Group. Springfields Works, Springfields, Lancs, England.
THE ABSORPTIOMETRIC DETERMINATION OF SILICON IN URANIUM METAL. Aug. 18, 1955. 7p.

The metal, in the form of turnings, is dissolved in a mixture of nitric and hydrochloric acids. The silicon is converted to silico-molybdic acid, and the complexed molybdenum is reduced to "molybdenum blue" and then determined absorptiometrically. The method is suitable for a concentration range of 5 to 250 ppm of soluble silicon. The insoluble silicon is usually low. (auth)

16792 SCS-M-412
United Kingdom Atomic Energy Authority. Industrial Group. Springfields Works, Springfields, Lancs, England.
THE DETERMINATION OF IRON IN NIOBIUM–MOLYBDENUM ALLOYS. Sept. 9, 1955. 5p.

A solution of niobium–molybdenum alloy is obtained by a potassium bisulfate fusion followed by an ammonium tartrate leach. The pH of the solution is adjusted, the iron reduced with hydroxylamine hydrochloride, and determined as its ferrous ortho phenanthroline complex absorptiometrically. The method is applicable to alloys containing up to 25% molybdenum. The iron content of the final solution should not exceed 500 μg. The precision (3σ) is equivalent to ± 4.5 μg iron at the 100 μg level.

16793 SCS-R-36
Gt. Brit. Springfields Works, Springfields, Lancs, England.
THE ESTIMATION OF MILLIGRAM AND MICROGRAM QUANTITIES OF URANIUM IN DIBUTYL CARBITOL SOLUTIONS: AN INVESTIGATION OF FACTORS AFFECTING THIS DETERMINATION AND A COMPARISON OF AVAILABLE METHODS. R. E. Cockaday, D. Swallow, and R. E. Worthington. Aug. 8, 1949. 12p.

The development of a method for the estimation of uranium (in concentrations of the order of 1 ppm) in dibutyl carbitol is reported. Main techniques investigated were: water extraction of the uranium followed by an absorptiometric determination, employing the coloration produced by the addition of hydrogen peroxide to solutions of uranium in sodium carbonate solution: direct fluorimetric estimation of the evaporated dibutyl carbitol solution; and chromatographic separation of the uranium on paper strips by the C.R.L. technique prior to fluorimetric estimation. The report shows that the lower limit for the colorimetric method is 200

microgram/ml and that the fluorimetric method is adequate for the range 0-200 microgram/ml. (auth)

16794 SCS-R-111

Gt. Brit. Springfields Works, Springfields, Lancs, England.

THE VOLUMETRIC DETERMINATION OF CHLORIDE IN NITRIC ACID SOLUTIONS OF URANIUM METAL RODS. J. R. Sanderson. Dec. 11, 1949. 5p.

A rapid, accurate method is described for the determination of chlorine which has been precipitated as silver chloride. The method is based on the fact that silver iodide is insoluble in ammonia, but soluble in ammoniacle potassium cyanide with the formation of potassium argentocyanide. (auth)

16795 UCRL-8686

California. Univ., Berkeley. Lawrence Radiation Lab.

CONSTITUTION OF THE VAPOR AND VAPOR PRESSURE OF SrO. L. Brewer and J. Drowart. Apr. 1959. 8p. Contract W-7405-eng-48. $0.50(OTS).

The high-temperature vaporization data of SrO have been reviewed. It is concluded that SrO vaporizes mainly to the elements under neutral conditions. The dissociation energy of the gaseous SrO molecule is 82 ± 5 kcal/mole. (auth)

16796 WADC-TR-57-651(Pt. II)

Connecticut Hard Rubber Co., New Haven.

DEVELOPMENT OF RUBBERLIKE MATERIALS FOR APPLICATIONS INVOLVING CONTACT WITH LIQUID ROCKET PROPELLANTS. Period Covered: April 1, 1958 to February 15, 1959. John H. Baldrige. Mar. 10, 1959. 82p. Project title: NON-METALLIC AND COMPOSITE MATERIALS. Task title: ELASTOMERIC AND COMPLIANT MATERIALS. Contract AF33(616)-5572. (AD-215424).

Elastomeric materials with satisfactory resistance during an immersion period of seven days at 160°F were developed for propellants such as JP-X fuel mixture, diisopropenyl acetylene, and hydrazine. Compounds based on an experimental polymer proved to be compatible with n-propyl nitrate and unsymmetrical dimethyl hydrazine, but additional work was directed toward development of other materials, based on commercial polymers, which will be resistant to these liquids. Compounds were tested which were resistant to inhibited red fuming nitric acid at room temperature. No elastomers tested were found resistant at room temperature to fluorine gas or nitrogen tetroxide. Results are presented for screening tests of plastics and fabrics in several propellants and for tests of elastomers in propellants at 350 and 400°F. (auth)

16797 WADC-TR-58-589

Wright Air Development Center. Materials Lab., Wright-Patterson AFB, Ohio.

THE SYNTHESIS OF SOME FLUORINE CONTAINING MONOMERS. Period covered: April 1, 1956 to January 1, 1958. William Durrell. July 1958. 35p. Project title: RUBBER, PLASTIC, AND COMPOSITE MATERIALS. Task title: SYNTHESIS AND EVALUATION OF NEW POLYMERS. (AD-214766).

Various methods of synthesis of fluorine-containing olefins with different functional groups were studied. The methods involved additions to olefinic double bonds, both free radical- and base-catalyzed. Attempts were made to prepare vinyl ethers, acrylonitrile derivatives, unsaturated olefin oxides, and vinyl ketones. A new, polymerizable unconjugated pentadiene, $CF_2 = CH-CF_2-CH = CF_2$, was prepared. Several new free radical addition reactions were carried out and a novel mode dimerization of α, β-unsaturated fluoro-ketones discovered. (auth)

16798 AAEC/E-20

POTENTIOMETRIC METHOD FOR THE DETERMINATION OF SODIUM IONS BY MEANS OF A GLASS ELECTRODE WITH A SODIUM FUNCTION. V. E. Goremykin and P. A. Kryukov. Translated by H. J. de Bruin from Izvest. Akad. Nauk S.S.S.R., Otdel Tekh. Nauk, 1387-9(1957). 5p.

The determination of ionic concentration of natural waters by means of a glass electrode with a sodium function is described. (auth)

16799 AEC-tr-3733

SOLUBILITY ISOTHERM AT 0° FOR THE SYSTEM $HF-CrO_3-H_2O$. N. E. Nikolaev and Iu. A. Buslaev. Translated for General Electric Co. Aircraft Nuclear Propulsion Project from Izvest. Sektora Fiz. Khim. Anal., Inst. Obshchei Neorg. Akad. Nauk S.S.S.R. 26, 270-4(1955). 5p. $1.80(ph), $1.80(mf) JCL or LC.

The solubility isotherm for the system $HF-CrO_3-H_2O$ at 0°C was studied within the concentration range of HF from 0 to 100%. Solid phases corresponding to CrO_3 and CrO_2F_2 were found in the system. The solubility of chromium fluoride in liquid hydrogen fluoride was measured at different temperatures. (auth)

16800 AEC-tr-3736

KINETIC ISOTOPE EFFECTS AND THEIR APPLICATION IN THE INVESTIGATION OF AZO-COUPLINGS. H. Zollinger. Translated for Oak Ridge National Lab. from Angew. Chem. 70, 204-10(1958). 35p. (Includes original, 7p.). $6.30(ph), $3.00(mf) JCL.

The causes of kinetic isotope effects are discussed in detail. Kinetic isotope effects in electrophilic aromatic substitutions are reported. The preparation of deuterium- and tritium-containing aromatic compounds is presented. (W.L.H.)

16801 AEC-tr-3749

KINETIC STUDY OF OXIDATION, NITRIDING, AND HYDROGENATION OF URANIUM. (Étude Cinétique de L'Oxydation, de la Nitruration et de l'Uranium.) Yves Adda. Translated for Oak Ridge National Lab. from report CEA-757, 1958. 89p. $13.80(ph), $4.80(mf) JCL.

The general and preliminary studies on the oxidation of uranium included the anomalies of oxidation found at 400°C, the influence of different factors, and the application of the rules of Pilling and Bedworth to the oxidation. The nitriding and hydriding of uranium are discussed. The results obtained in the study of the kinetics of oxidation, hydridation, and nitridation of uranium are compared. The influence of the crystalline structure and surface condition is considered. (J.E.D.)

16802 CEA-tr-A-528

L'INFLUENCE DE LA TEMPÉRATURE SUR L'OXYDATION DU FER PUR DANS L'OXYGEN. (The Influence of Temperature on the Oxidation of Pure Iron in Oxygen.) N. G. Schmahl, H. Baumann, and H. Schenck. Translated into French from Arch Eisenhüttenw. 29, 83-8(1958). 21p.

A new determination was made of the oxidation constants of electrolytic iron in oxygen at atmospheric pressure for temperatures between 480 and 1080°C. The results showed that the oxidation curve is subdivided into almost rectilinear parts at the monoxide point (566°), at the Curie point of magnetite (579°), at

616°, at the Curie point of iron (~760°), and probably at $\alpha-\gamma$ transformation of iron (910°). Micrographic examinations showed that the monoxide layer, during the oxidation of iron, contains magnetite only after cooling. The type and the quantity of the magnetite precipitated are a function of the type of cooling used. The results are compared with previous investigations. (J.S.R.)

16803 CEA-tr-A-568

DOSAGE DU BISMUTH DANS LE PLOMB ET L ETAIN PAR EXTRACTION A LA THIONALIDE. (Determination of Bismuth in Lead and Tin by Extraction with Thionalide.) H. Lilie. Translated into French by B. Moreau from Z. anal. Chem. 159, 196-202(1957). 15p.

The conditions for the extraction of bismuth with thionalide in chloroform solution were investigated. After extraction the bismuth is determined photometrically. The presence of free acid hinders the extraction of bismuth, and the hydrogen ion concentration most favorable for the extraction is between pH 1 and 2. The experimental conditions for the determination in lead and tin were determined. The values found were compared with those obtained by gravimetric and polarographic methods. (J.S.R.)

16804

CRYSTAL CHEMICAL STUDIES OF THE 5f-SERIES OF ELEMENTS. XXV. THE CRYSTAL STRUCTURE OF SODIUM URANYL ACETATE. W. H. Zachariasen and H. A. Plettinger (Argonne National Lab., Lemont, Ill. and Univ. of Chicago). Acta Cryst. 12, 526-30 (1959) July 10.

Sodium uranyl acetate, $NaUO_2(O_2CCH_3)_3$, is cubic with space group $P2_13$ and $\alpha = 10.688 \pm 0.002$ A. The positions of all atoms were deduced from precisely measured x-ray-diffraction intensities. In the collinear uranyl group U–O = 1.71 ± 0.04 A. Normal to the uranyl axis are six secondary bonds from uranium to acetate oxygens with U–O = 2.49 ± 0.02 A. Sodium is bonded to six acetate oxygens with Na–O = 2.37 ± 0.04 A. The bond lengths within the acetate group are C–C = 1.52 ± 0.05 A, C–O = 1.26 ± 0.05 A, and 1.28 ± 0.04 A, and 121° is found for the carboxyl bond angle. A revised bond length versus bond strength curve for U^{VI}–O bonds is presented. (auth)

16805

THE CRYSTAL STRUCTURE OF YSi AND $Hf_5Ge_3(C)$. Erwin Parthé (Massachusetts Inst. of Tech., Cambridge) Acta Cryst. 12, 559-60(1959) July 10.

Intensity calculations were made for YSi with CrB structure and for $Hf_5Ge_3(C)$ with $D8_8$ structure. Results are tabulated. (C.J.G.)

16806

SIMULTANEOUS SPECTROPHOTOMETRIC DETERMINATION OF NIOBIUM AND TUNGSTEN. APPLICATION TO COMPLEX ALLOY AND STAINLESS STEELS. Bruce McDuffie, William R. Bandi, and Laben M. Melnick (U. S. Steel Corp., Monroeville, Penna.). Anal. Chem. 31, 1311-15(1959) Aug.

A thiocyanate method has been developed for the simultaneous spectrophotometric determination of niobium and tungsten. After preliminary reduction of tungsten(VI) to tungsten(V) by stannous chloride in hydrochloric acid solution, the total absorbance of the niobium(V) and tungsten(V) thiocyanates is measured at 400 mμ in a 0.30M thiocyanate, 20 volume % acetone medium. Oxalate is added to bleach the niobium color, and the absorbance due to tungsten alone is then measured. The difference in absorbances gives the niobium concentration. The method is applicable in the presence of tantalum, titanium, and molybdenum, elements which may be found with niobium and tungsten in the mixed oxide precipitate from the acid-hydrolysis treatment of steel and alloy samples. The method has been tested with various National Bureau of Standards stainless steels and cobalt-base alloys. (auth)

16807

POLAROGRAPHY OF URANIUM(IV) IN NONCOMPLEXING AND COMPLEXING MEDIA. AMPEROMETRIC DETERMINATION OF FLUORIDE. David J. McEwen and Thomas De Vries (Purdue Univ., Lafayette, Ind.). Anal. Chem. 31, 1347-51(1959) Aug.

The polarography of uranium(IV) has been studied. The effect of pH on the half-wave potential of the anodic wave has been determined in noncomplexing (perchlorate, chloride, and sulfanilate-buffered) and complexing (formate, acetate, and monochloroacetate) media. The diffusion current constants of uranium(IV) in formate, acetate, and monochloroacetate buffers were found to be 2.67, 2.17, and 1.93, respectively. With the anodic wave used to detect the end point, an amperometric method for determining fluoride in formate buffer of pH 3.6 is given, for which the fluoride to uranium ratio is 2. From 0.04 to 2.2 mg of fluoride have been determined. (auth)

16808

AMPEROMETRIC TITRATION OF BARIUM. H. E. Zittel, F. J. Miller, and P. F. Thomason (Oak Ridge National Lab., Tenn.). Anal. Chem. 31, 1351-3(1959) Aug.

An amperometric titration of barium in a medium of tetræthylammonium bromide in an ethyl alcohol–water solution is described. Lithium sulfate is the titrant and the dropping mercury electrode is the indicator electrode. The method is similar to that first described by Heyrovský and Berezicky but differs in the medium and supporting electrolyte. Because of these modifications, the sensitivity of the method is greatly increased. It was possible to titrate solutions that were 5×10^{-5}M in barium with reasonable accuracy. The accuracy varies from less than 1% error in the concentrated samples, i.e., $>2.5 \times 10^{-3}$M, to less than 10% error in the more dilute samples, i.e., $<5 \times 10^{-5}$M. (auth)

16809

PHOTOMETRIC TITRATION OF THORIUM AND THE RARE EARTHS WITH (ETHYLENEDINITRILO)TETRAACETIC ACID. Kazimierz Y. Bril, Sonja Holzer, and Béla Réthy (Research Lab., Orquima S. A., Sao Paulo, Brazil). Anal. Chem. 31, 1353-7(1959) Aug.

Thorium and the rare earths are titrated with (ethylenedinitrilo)tetraacetic acid using Alizarin Red S as indicator. Photometric end point detection increases the sensitivity of the method. Determinations can be made at concentrations as low as 5.10^{-6}M. In the case of the cerium group rare earths, the method allows simultaneous determination of both thorium and the rare earths. As little as 0.1% of thorium in the rare earths, or 0.2% of the rare earths in thorium, can be evaluated. The interference of cerium is eliminated by the addition of hydroxylamine hydrochloride. The method is applied to naturally occurring mixtures, after some conventional separations. (auth)

16810

DETERMINATION OF ZIRCONIUM IN ZIRCONIUM DRIERS. EDTA TITRATION IN 1 TO 4 SULFURIC ACID. Clyde F. Hirn and Claude A. Lucchesi (Sherwin-

Williams Co., Chicago). Anal. Chem. 31, 1417-18(1959) Aug.

A simple titrimetric method for the determination of zirconium in zirconium naphthenate and octoate driers is rapid and precise and yields results in close agreement with the mandelic acid gravimetric procedure. The drier is dissolved in 1 to 4 sulfuric acid, and an excess of standard EDTA solution is added. The unreacted EDTA is back-titrated with standard bismuth nitrate solution to the thiourea end point. Only 0.3 gram of sample is required, and a single determination can be made in 40 minutes. The standard deviation of the method for a 6% drier is 0.03%. (auth)

16811

MELTING POINT APPARATUS FOR SIMULTANEOUS OBSERVATION OF SAMPLES IN TRANSMITTED AND REFLECTED LIGHT. H. E. Ungnade, E. A. Igel, and B. B. Brixner (Los Alamos Scientific Lab., N. Mex.). Anal. Chem. 31, 1432-3(1959) Aug.

A melting point apparatus utilizes an electrically heated copper block and an optical system which projects both transmitted and reflected images of the sample side by side on a rear projection screen. It is particularly suitable for use with explosive materials. (auth)

16812

TARTRAZINE, A NEW SELECTIVE REAGENT FOR ZIRCONIUM. Gh. Baiulescu and L. Turcu (Univ. I. C. Parhon, Bucharest). Anal. Chim. Acta 21, 33-5(1959) July.

A new method for determining zirconium is described, in which tartrazine serves as reagent. The precipitate can be ignited to ZrO_2 or weighed as the complex. The reagent appears to be very selective, and can be used for the determination of zirconium in alloys and ores. (auth)

16813

DETECTION OF THE HEAVIER RARE-EARTH METAL IONS WITH SEVERAL ORGANIC REAGENTS. Wesley W. Wendlandt and Roger G. Sewell (Texas Technological Coll., Lubbock). Anal. Chim. Acta 21, 94-5(1959) July.

Detection of the heavier rare-earth ions with oxalic acid, cupferron, 8-quinolinol, and 2-methyl-8-quinolinol is reported. The sensitivity of the tests decreased with increase in atomic number of the rare-earth metal ion. (C.J.G.)

16814

ANALYSIS OF HEAVY WATER IN CONCENTRATIONS APPROXIMATE TO THAT EXISTING IN NATURAL WATER. I. J. L. Otero de la Gandara and M. Gispert Benach. Anales real soc. espaf. fís. y quím. (Madrid) Ser. B 55B, 73-82(1959). (In Spanish)

A simple inexpensive apparatus is described which can be used to determine D_2O in natural water by the float method. The D_2O in natural water is concentrated by electrolysis to a convenient level in four electrolytic cells. Two controls and two unknowns are run simultaneously in series. The method gives results with a maximum relative error of 3%. (T.R.H.)

16815

MASS PRODUCTION OF PURE RARE EARTHS. R. A. Labine. Chem. Eng. 66, 104-7(1959) July 27.

A discussion of the ion exchange process for extraction of rare earth mixtures now used by Michigan Chemical Corp. is given. A flowsheet is presented showing process setup and arrangement. (C.J.G.)

16816

CONTINUOUS DISSOLUTION OF URANIUM–ALUMINUM FUELS IN A TRICKLE-TYPE COLUMN DISSOLVER. J. C. Bresee (Oak Ridge National Lab., Tenn.); D. L. Foster (Convair, Fort Worth, Tex.); and E. O. Nurmi (Engelhard Industries, Inc., Newark, N. J.). Chem. Eng. Progr. 55, Symposium Ser. No. 22, 25-32(1959).

The performance of a full-scale continuous dissolver with suitable dimensions for power reactor enriched fuel dissolution was investigated. Results on a full-scale continuous trickle-type column dissolver for enriched uranium–aluminum fuels are presented. Both cast and extruded unirradiated alloys were dissolved, and correlations relating dissolving rate and product concentration to feed acid rate and concentration for both types of alloy are given. The application of the correlations to column design and operation is discussed. (auth)

16817

TITRATION WITH HYDROQUINONE AND SIMILAR REDUCTION METHODS. X. TITRATION OF CERIUM, CHROMIUM, AND VANADIUM AND THE POSSIBILITY OF THEIR SIMULTANEOUS DETERMINATION. L. Mráz, V. Simon, and J. Zýka (Karlsuniversität, Prague). Collection Czechoslov. Chem. Communs. 24, 1487-91(1959) May. (In German)

The reduction conditions for the accurate determination of small amounts of cerium, chromium, and vanadium were studied. On the basis of the results obtained, the determination of these elements, in the presence of permanganate ions, by a single potentiometric titration with a standard hydroquinone solution was investigated. (tr-auth)

16818

APPLICATION OF AMINO COMPOUNDS IN THE POLAROGRAPHY OF INORGANIC SUBSTANCES. VII. POLAROGRAPHIC DETERMINATION OF COPPER AND IRON IN NICKEL AND ALUMINUM AND IN THEIR SALTS. J. Doležal and J. Novák (Karlsuniversität, Prague). Collection Czechoslov. Chem. Communs. 24, 1718-20(1959) May. (In German)

A method for the simultaneous polarographic determination of copper and iron in nickel or aluminum and their salts is presented. The electrolyte used is 0.8 M ethylenediamine tartrate and 0.08 M sodium pyrophosphate. The method is applicable to the analysis of nickel and aluminum alloys. (J.S.R.)

16819

THE PREPARATION OF CHOLINE URANATES. Colette Soye. Compt. rend. 248, 2565-7(1959) June 22. (In French)

The precipitation of $UO_2(NO_3)_2 \cdot 6H_2O$ in aqueous solution by increasing quantities of an aqueous solution of choline ($C_5H_{15}O_2N$) leads to two kinds of uranates: $U_4O_{13}(C_5H_{14}ON)_2$ (orange), and $U_3O_{10}(C_5H_{14}ON)_2$ (bright yellow). The latter precipitate dissolves in an excess of choline. (tr-auth)

16820

FORMATION OF CHROMIUM CARBIDES. T. Ya. Kosolapov and G. V. Smasonov (Inst. of Metaloceramics and Special Alloys, Academy of Sciences, Ukrainian S.S.R.). Dopovidi Akad. Nauk Ukr. R.S.R. No. 3, 298-300(1959). (In Russian)

A study is reported of the process of the formation of Cr_3C_2 and Cr_7C_3 by the reduction of chromium oxide with carbon black in a hydrogen atmosphere. The optimum conditions for the formation of Cr_3C_2 and

Cr_7C_3 are established. It is shown that $Cr_{23}C_7$ cannot be obtained by this method. (auth)

16821

SIMPLIFIED FLOAT METHOD FOR THE DETERMINATION OF THE D_2O CONTENT OF WATER. P. Baertschi and M. Thürkauf (Univ. of Basel). Helv. Chim. Acta 42, 282-93(1959). (In German)

A simplified and tested modification of the well known float method for the isotopic analysis of water is described. It is shown that an accuracy better than 0.01% D-content is easily obtained by means of very simple equipment for the purification of the water samples and for the determination of the floating temperatures. Numerical tables for the calculation of the isotopic composition are given, and the corrections which have to be applied are discussed. Curves of constant density provide the fastest method for the routine evaluation of the D-content from floating temperatures. (auth)

16822

ISOTOPIC ANALYSIS OF OXYGEN IN INORGANIC COMPOUNDS. M. Anbar and S. Guttmann (Weitzmann Inst. of Science, Rehovoth, Israel). Intern. J. Appl. Radiation and Isotopes 5, 233-5(1959) May.

A semimicro method has been developed for analyzing the isotopic composition of various inorganic compounds, including oxides, anions, and water. The samples are heated to 400°C with a mixture of $HgCl_2$ and $Hg(CN)_2$; the CO_2 formed is purified for analysis over zinc amalgam at 200°C. An analysis of the oxides, salts, and water by the $HgCl_2$–$Hg(CN)_2$ method is presented in tabular form. (C.J.G.)

16823

RATES OF REACTION OF HYDROGEN WITH IODINE. John E. Sullivan (Los Alamos Scientific Lab., N. Mex.). J. Chem. Phys. 30, 1292-1300(1959) May.

The rates of reaction of hydrogen with iodine have been measured at 633.21, 666.79, 710.33, and 737.93°K with at least a tenfold variation in the hydrogen and iodine concentrations at each temperature. The data have been treated considering the elementary reactions to be $I_2 \rightleftharpoons 2I$, $H_2 + I_2 \rightarrow 2HI$, $2HI \rightarrow H_2 + I_2$, $I + H_2 \rightarrow HI + H$, $H + HI \rightarrow H_2 + I$, $H + I_2 \rightarrow HI + I$, and $I + HI \rightarrow I_2 + H$. This classical reaction has long been considered to consist solely of the simple bimolecular reactions (1) and (2). However, the atom mechanism, reactions (3) to (6), is shown to account for 10% of the over-all reaction at 633 and 27% at 738°K when the iodine pressure is one-half atmosphere. The three independent constants k_1, k_3, and k_4/k_5 in $(mole/cc)^{-1}$ sec^{-1}, are given by $\log_{10}(k_1/T^{1/2}) = 12.78 - 40740/4.575T$, $\log_{10}(k_3/T^{1/2}) = 12.75 - 33440/4.575T$, and $k_4/k_5 = 0.07$, 0.082, 0.117, 0.125 at the experimental temperatures 633, 667, 710, and 738°K. (auth)

16824

PREDICTION OF ISOMERIC FORM AND BOND ANGLES FOR COVALENT MOLECULES AND IONS. Alan W. Searcy (Univ. of California, Berkeley). J. Chem. Phys. 31, 1-4(1959) July.

An electrostatic model for prediction of bond angles in covalent molecules is extended to molecules and ions whose central atoms are surrounded by five or six valence electron pairs of which at least one pair is a lone pair. The stable isomers are the isomers which provide the lone pair electrons with the maximum possible cone of space adjacent to the central atom. Angular deflections from symmetrical coordination positions in these molecules are in the directions predicted by the model, but the observed deflections are usually less than those expected on the basis of behavior in simpler molecules. (auth)

16825

TWIST IN LITHIUM FLUORIDE WHISKERS. Gerald W. Sears (General Electric Research Lab., Schenectady, N. Y.). J. Chem. Phys. 31, 53-4(1959) July.

Eshelby twists have been observed microscopically on very fine lithium fluoride whiskers grown from aqueous solution. (auth)

16826

ABSORPTION SPECTRA AT 4°K OF SINGLE CRYSTALS OF NORMAL AND ISOTOPICALLY SUBSTITUTED SODIUM AND POTASSIUM NITRATES. Edward V. Sayre (Brookhaven National Lab., Upton, N. Y.). J. Chem. Phys. 31, 73-80(1959) July.

Sharp line structure is observed in the low energy shoulder of the 3000 A absorption band of crystalline nitrates that have been cooled to 4°K. Single crystals of normal and of nitrogen-15 isotopically substituted sodium and potassium nitrates were examined spectrographically. Correlation between the spacings, polarization and orientation properties, isotope effect, and crystal field splitting of the spectra permitted their analysis. In terms of the D_{3h} point symmetry of a free nitrate ion the excited electronic state is E′. This electronic configuration is one of three considered likely upon the basis of a LCAO molecular orbital treatment of the ion. The two asymmetric E′ vibrations of the ion predominantly contribute to the band structure. A large Franck-Condon shift, an extensive weakening of force constants, and the character of the excited vibrations indicate that the excited ion is planar but expanded with perhaps some, but not a great amount of asymmetric distortion. Predissociation appears at a level corresponding to a dissociation energy of 3.76 ev for the nitrate ion. (auth)

16827

HYDROGEN → DEUTERIUM EXCHANGE REACTION IN FIBROUS PROTEINS. [PART] II. R. D. B. Fraser and T. P. Macrae (C.S.I.R.O. Wool Research Labs., Melbourne). J. Chem. Phys. 31, 122-6(1959) July.

Previously it has been shown that when α-keratin is reacted with deuterium oxide the peptide hydrogens in the crystalline regions are not replaced by deuterium. In the present contribution it is shown that when the native configuration of this protein is destroyed, for example by stretching or supercontraction, complete replacement is obtained. Neither cleavage of the disulfide linkages nor treatment with acetic acid-d, which reduces the crystallinity appreciably, effects complete exchange in α-keratin and it is presumed therefore that the array of hydrogen bonds in the native monomeric unit is one of high inherent stability. This stability is attributed to its α-helical configuration, cyclic nature, and to interactions between side chains along the area of contact between the helix pair forming the cyclic unit. When collagen is reacted with deuterium oxide, complete exchange is rapidly attained and this is correlated with the fact that the hydrated collagen is not appreciably stabilized by side-chain interactions and that the hydrogen bond array is only partially intrahelical. (auth)

16828

ELECTRON POPULATION ANALYSIS OF LiH AND HF.

A. M. Karo (Massachusetts Inst. of Tech. Lincoln Lab., Lexington). J. Chem. Phys. 31, 182-92(1959) July.

Following the analysis proposed by Mulliken, SCF LCAO-MO coefficients for LiH and HF are used to obtain qualitative information about the electron distributions in these molecules. Several additional aspects of population analysis are considered: the variation of atomic and overlap populations with internuclear distance and with choice of basis atomic orbitals, and the extent to which CI alters the qualitative description. It is shown that at equilibrium distances the results appear to be qualitatively unchanged by CI but are rather sensitive to the choice of basis functions. (auth)

16829

CHARGE PERMUTATION AND DISSOCIATION OF MOLECULAR IONS BY IMPACT WITH NEUTRAL MOLECULES. F. M. Rourke, J. C. Sheffield, W. D. Davis, and F. A. White (Knolls Atomic Power Lab., Schenectady, N. Y.). J. Chem. Phys. 31, 193-9(1959) July.

Resolved beams of ions with energies between 10 and 150 kev were passed through thin targets and the resulting beam analyzed as to momentum and energy. Equilibrium charge ratios were obtained for various ions after passing through thin films of Ni or organic polymer. Cross sections for several reactions of oxygen ions with gas targets were also obtained. For gaseous targets, some of the products of dissociative reactions exhibited two side peaks differing in energy from the normal peak. By relating this displacement to a velocity change produced by dissociation alone, the kinetic energy change involved in the dissociation of the ion can be calculated. Values for a number of cases are tabulated. (auth)

16830

ISOTOPE ENRICHMENT FACTORS FOR NITROGEN-15 IN THE NITRIC OXIDE–NITRIC ACID EXCHANGE SYSTEM. Lois Nash Kauder, T. I. Taylor, and W. Spindel (Columbia Univ., New York). J. Chem. Phys. 31, 232-5(1959) July

Single stage enrichment factors, α, for the isotope exchange reaction of nitrogen-15 between oxides of nitrogen and solutions of nitric acid have been determined by two different methods. Single stage equilibrations resulted in values of α that decrease from 1.065 for approximately 1M HNO_3 to 1.045 for 11.1M HNO_3. At high acid concentrations, α decreases rapidly owing to high concentrations of NO_2 and N_2O_4 in the gas phase. Steady-state over-all separations in an exchange column at several rates of product withdrawal gave an independent determination for the 10M HNO_3 used in the preparation of highly enriched nitrogen-15. Data from the two methods result in a value for α of 1.055 ± 0.005 for approximately 10M HNO_3 at 25°C. (auth)

16831

NUCLEAR MAGNETIC RESONANCE STUDY OF BORON CARBIDE. A. H. Silver and P. J. Bray (Brown Univ., Providence). J. Chem. Phys. 31, 247-53(1959) July.

A nuclear magnetic resonance (NMR) study of boron carbide has been conducted using both powdered and single crystal samples. The resonance patterns for B^{11} were observed at several Larmor frequencies from 5.53 to 17.7 Mcps. Analyses of the spectra with the application of the quadrupole interaction show that there are three crystallographically nonequivalent boron positions, contrasted with the two positions given by x-ray structure determinations. Estimated quadrupole coupling constants for the $6h_1$ and $6h_2$ positions are given. The third position is assigned to 1b, previously believed to be occupied by carbon atoms. In the 1b positions, the quadrupole coupling constant of the B^{11} nuclei is 5.58 ± 0.02 Mcps. Large variations in the width and shape of the resonance from the 1b atoms are explained by the presence of many small angle grains in the single crystal which produce variations in orientations of the local principal axis systems. (auth)

16832

JAHN-TELLER EFFECT IN THE VIBRATIONAL SPECTRA OF HEXAFLUORIDES. Bernard Weinstock and Howard H. Claassen (Argonne National Lab., Lemont, Ill.). J. Chem. Phys. 31, 262-3(1959) July.

The Jahn-Teller effect in the vibrational spectra of several inorganic hexafluorides is briefly discussed in relation to Raman fundamentals. (C.J.G.)

16833

RELATIONSHIP BETWEEN IONIZATION POTENTIALS AND ATOMIC RADII. W. W. Hunt, Jr. and Robert E. Huffman (Air Force Cambridge Research Center, Bedford, Mass.). J. Chem. Phys. 31, 266-7(1959) July.

A relationship between the mean atomic radii and the ionization potentials of the rare gas atoms, based upon the ionization process, is discussed. Values of the radius of collision complex are given. (C.J.G.)

16834

KINETIC STUDIES ON CORROSION SYSTEMS. I. POLYELECTRODES UNDER ACTIVATION CONTROL. Franz A. Posey (Oak Ridge National Lab., Tenn.). J. Electrochem. Soc. 106, 571-81(1959) July.

Electrochemical kinetics has been applied to the case of corroding polyelectrodes under activation control for the situation where the rates of partial processes vary over the surface of an electrode. Explicit expressions have been derived for rate and potential in the simplest polyelectrode systems. The kinetics of galvanic couples under activation control has been derived with emphasis on the significance of measurable quantities. The use of steady-state polarizability measurements, potentiostatic measurements, and galvanostatic measurements in the study of polyelectrode systems has been outlined. (auth)

16835

KINETIC STUDIES ON CORROSION SYSTEMS. II. THE REDUCTION OF CUPRIC ION ON PASSIVE STAINLESS STEEL ELECTRODES. Franz A. Posey, G. H. Cartledge, and R. P. Yaffe (Oak Ridge National Lab., Tenn.). J. Electrochem. Soc. 106, 582-625(1959) July.

The reduction of cupric ion on the surface of passive stainless steel electrodes in aerated, dilute sulfuric acid medium has been investigated using potentiostatic, galvanostatic, and tracer techniques. The independent simultaneity of the electrode reactions has been demonstrated. A mechanism is advanced for the reduction of cupric ion on the oxide surface. The data are interpreted on the basis of electrochemical kinetics. (auth)

16836

TRANSPORT NUMBERS IN PURE FUSED SALTS. THE ALKALI METAL CHLORIDES. Frederick R. Duke and Allen L. Bowman (Inst. for Atomic Research, Iowa State College, Ames). J. Electrochem. Soc. 106, 626-7 (1959) July.

The transport number of the chloride ion has been determined in fused alkali chloride salts by a radiochlorine tracer technique, using a membrane cell.

Values obtained are compared with theoretical predictions of Mulcahy and Heymann and of Sundheim. (auth)

16837

FORMATION OF HYDRIDE FILMS ON Ti, Zr, Hf, Th DISSOLVING IN HYDROFLUORIC ACID. W. J. James and M. E. Straumanis (Univ. of Missouri, Rolla). J. Electrochem. Soc. 106, 631-2(1959) July.

Small pieces of low Hf content Zr and Ti metal were immersed in 0.1 N HF for 1 hr. The films were removed, dried, and crushed to a powder. Powder diffraction pictures, using Cu Kα radiation with a Ni filter, were taken, and "d" values of the pattern are tabulated and compared with data from many sources. Close agreement with hydride patterns and standards are indicated. (C.J.G.)

16838

SOME MORPHOLOGICAL STUDIES OF SILVER CRYSTALS ELECTRODEPOSITED FROM LiCl–KCl EUTECTIC MELT CONTAINING AgCl. Ling Yang, Chien-yeh Chien, and Robert G. Hudson (Carnegie Inst. of Tech., Pittsburgh). J. Electrochem. Soc. 106, 632-4(1959) July.

Observations are made on silver crystals electrodeposited from LiCl–KCl eutectic melt containing AgCl at 50°C. Macroscopic appearances are given of the crystals. (C.J.G.)

16839

X-RAY FLUORESCENCE ANALYSIS. F. Brown (Imperial Chemical Industries Ltd., Durham, Eng.). J. Geophys. Research 84, 344-55(1959) July.

The general principles, development, equipment, applications, and quantitative analysis procedures using x-ray fluorescence are discussed. (C.J.G.)

16840

SPECTROSCOPIC STUDIES OF Al ALLOYS IN NITROGEN ATMOSPHERE. Tibor Kántor. Magyar Tudományos Akad. Központi Fiz. Kutató Intézetének Közleményei 6, 56-65(1958) Jan.-Apr. (In Hungarian)

A gas cell, air tight even for counter electrode arc generating processes with large metal bodies, is described. Excitations in air, argon, and nitrogen atmospheres are compared with respect to the spectroscopic analysis of aluminum. Arc discharge is more stable in nitrogen atmosphere, and disturbing oxide bands in the visible spectrum are eliminated. Sensitivity and accuracy are increased. Carbon was found to be the most suitable electrode material. (auth)

16841

SEPARATION OF Th, Zr AND Nb FROM SULPHATE MEDIA BY ANION EXCHANGE. Ferenc Molnár and György Tóth. Magyar Tudományos Akad. Központi Fiz. Kutató Intézetének Közleményei 6, 66-70(1958) Jan.-Apr. (In Hungarian)

The anion exchange adsorption rate of Th, Zr, and Nb from sulfate solution was studied. A Hungarian-made quaternary amine type of resin Mykion PA was used for the experiments. Considering the differences between the distribution ratios of Th, Zr, and Nb, the separation of these elements from sulfate solutions by ion exchange was found to be possible, and on the basis of the distribution studies the separations were carried out. (auth)

16842

STUDY OF HYDROGEN-DEUTERIUM EXCHANGE ON ION EXCHANGERS IN THE HETEROGENEOUS PHASE. I. CATION EXCHANGERS. Piroska Fodorné Csányi. Magyar Tudományos Akad. Központi Fiz. Kutató Intézetének Közleményei 6, 71-97(1958) Jan.-Apr. (In Hungarian)

Hydrogen–deuterium exchange on the cation exchangers Amberlite IR-120 and Amberlite IRC-50 in deuterium oxide solution was studied in terms of such variables as nature of the cation exchanger group, temperature, and solution pH. Exchange rate and deuterium mole fraction on the resin are higher for sulfonic acid type resin than for carboxyl resin though the capacity is higher for the latter type. No appreciable exchange is to be observed at 20°C, but exchange increases with the increase of temperature. For Amberlite IRC-50 the exchange rate decreases because of resin deterioration beyond 75°C. By altering the pH of the deuterium oxide solution with hydrochloric or sulfuric acid, the exchange capacity for Amberlite IR-120 will increase. For Amberlite IRC-50 the exchange capacity decreases with the decrease of pH. For both resins, exchange rates are higher in acid than in neutral solutions. The separation factor is always smaller than unity for carboxyl resins because of the formation of hydrogen bridges between the carboxyl group and the adhered water. For sulfonic acid resins a separation factor higher than unity was found because one part of the RSO_3H groups forms RSO_3^-, OH_3^+ ion complexes. This is, however, an inhibited process and favored by increasing temperature. (auth)

16843

LOWEST OXIDATION STATES OF TECHNETIUM AND RHENIUM. R. Colton, J. Dalziel, W. P. Griffith, and G. Wilkinson (Imperial Coll. of Science and Tech., London). Nature 183, 1755(1959) June 20.

The polarographic reductions of potassium perrhenate and pertechnate in 2N potassium chloride were compared. The nature of the reduced products is described and discussed. (C.H.)

16844

THE URANIUM CONTENT OF SAALE RIVER WATER. F. Heide and G. Proft (Mineralogische Inst., Jena, Ger.). Naturwissenschaften 46, 352-3(1959). (In German)

The fluorimetric method was used for the determination of the uranium content of Saale River water. Two samples from each location were taken, and one was used to determine the total uranium content and the other was used to measure the uranium content of the suspensions in the water. The results are tabulated. (J.S.R.)

16845

ON THE REACTION BETWEEN CERIUM(IV) IONS AND PEROXYSULPHURIC ACID. L. J. Csányi, F. Solymosi, and J. Szücs (Univ. of Szeged, Hungary). Naturwissenschaften 46, 353(1959).

During cerimetric determination of solutions containing hydrogen peroxide and peroxysulfuric acid, the amount of peroxysulfuric acid consumed depends on the rate of titration. Since the same consumption occurs in the absence of hydrogen peroxide, the decomposition must be attributed to the reaction between cerium(IV) ions and peroxysulfuric acid. Therefore, cerimetric titrations with ceric sulfate and ceric nitrate were investigated. The results showed that in the presence of sulfate ion, the amount of peroxysulfuric acid decomposed in one minute increases proportional to the concentration of Ce^{4+}. The addition of Ce^{3+} to the solution de-

creases the decomposition as a function of the ratio Ce^{4+}/Ce^{3+}. The reaction between peroxysulfuric acid and Ce^{4+} is more rapid in the presence of nitrate ions than sulfate ions. The reaction rate increases with the addition of Ce^{3}. (J.S.R.)

16846

DETERMINATION OF OXYGEN IN ZIRCONIUM METAL BY VACUUM FUSION METHOD AND BROMINATION-CARBON REDUCTION METHOD. Yasaumoto Ôtake. Nippon Kinzoku Gakkaishi 22, 341-5(1958) July. (In Japanese)

Determination of oxygen in zirconium metal was studied by the vacuum fusion method and the bromination–carbon reduction method. In the vacuum fusion method, the iron–tin bath technique usually applied for the analysis of gases in titanium metal was used. In this case the molten iron bath in a graphite crucible is the reaction medium. The sample reacts with the molten iron bath containing tin to form a stable carbide of zirconium. At a furnace temperature of 1850°C, complete reduction of the oxides is effected within 30 minutes. The evolved gases are extracted and analyzed. In the bromination–carbon reduction method, the sample is mixed with carbon and treated with bromine at 925°C, using argon as carrier gas. The oxygen in the sample is converted into carbon monoxide, which is then oxidized to carbon dioxide with hot copper oxide. The carbon dioxide is absorbed into a weighing bulb containing sodium hydroxide. The results with various samples of materials with these methods show a good agreement. In the vacuum fusion method, oxygen in zirconium metal could be determined with an accuracy of ±0.01%. (auth)

16847

SPECTROGRAPHIC DETERMINATION OF B, Fe, Mn, Mg AND Al IN URANIUM BASE MATERIALS. Tokunosuke Nakazima, Masao Takahashi, and Hiroshi Kawaguchi. Nippon Kinzoku Gakkaishi 22, 508-12(1958) Oct. (In Japanese)

The important factor required for the utilization of uranium as a source of atomic energy are the removal of such impurities which show non-fission capture of neutrons as completely as possible. Consequently the production of uranium involves a most searching analysis of such elements. In 1946, B. G. Scribner et al. developed a very sensitive spectrographic method for this purpose, that is, the so-called carrier-distillation method. The method involves the preliminary conversion of the sample matrix to a form having low volatility before the final spectrographic procedures. The authors found that this procedure was the most critical and elaborate, and they investigated thoroughly this procedure and distinguished the many factors which may or may not influence the final results. The procedure was applied to the determination of B, Fe, Mn, Mg, and Al. High sensitivity, down to 0.05 ppm for B, 7 ppm for Fe, 6 ppm for Mn, 2 ppm for Mg, and 20 ppm for Al and reasonably good reproducibility (±5 to 10%) were obtained. (auth)

16848

DETERMINATION OF RARE EARTH ELEMENTS IN URANIUM COMPOUNDS. Tokunosuke Nakazima, Masao Takahashi, and Hiroshi Kawaguchi. Nippon Kinzoku Gakkaishi 22, 564-8(1958) Nov. (In Japanese)

A method has been developed for the determination of rare earth elements including yttrium in uranium and its compounds. The greater portion of the uranium is separated from the rare earths by ether extraction. The rare earths are then precipitated as fluorides and subsequently purified as hydroxides. Lanthanum was used as the carrier. The efficiency of the separation procedures was studied by means of the radioactive tracer $Eu^{152+154}$. The final determination was carried out spectrographically by the copper-spark method. Five rare earth elements which showed extremely high neutron absorption were investigated, and their limits of detection (sensitivity) and recoveries from U_3O_8 are reported. (auth)

16849

CHEMICAL REACTIONS OF POSITRONIUM IN AQUEOUS SOLUTIONS. J. McGervey and S. DeBenedetti (Carnegie Inst. of Tech. Pittsburgh). Phys. Rev. 114, 495-6(1959) Apr. 15.

An attempt to a preliminary but systematic study of the chemical properties of the element positronium is described. It is verified (in agreement with Green and Bell) that positrons react with nitrates; it is believed that this reaction is an oxidation process. It is found that positronium is not so readily attacked by the ions Cl^- and SO_4^{2-}. In chloride and sulfate solutions positronium more effectively replaces the metals which are lowest in the electrochemical series: this result opens the possibility of determining the position of positronium in the electrochemical scale. (auth)

Radiation and Radiochemistry

16850 A/CONF.15/P/340

ETUDES RELATIVES AU COMPORTEMENT PHYSICO-CHIMIQUE DE L'EAU LOURDE DANS LES REACTEURS NUCLEAIRES. (Studies Relative to the Physico Chemical Behaviour of Heavy Water in Nuclear Reactors.) J. Chenouard, G. Dirian, E. Roth, P. Vignet, and R. Platzer (Commissariat à l'Énergie Atomique, Paris). 58p.

Among the degradations suffered by heavy water in nuclear reactors the two most important and closely linked are pollution and radiolytic decomposition. The pollution of the water, chiefly by the corrosion products from the structural materials, has led to the perfection of purification circuits employing organic ion exchanger. Their operation in the present case demands some special arrangements: a thorough initial deuteration in order to avoid isotopic pollution of the reactor water; and particular precautions in the handling of spent resins, which are strongly radioactive. These operations and their working out in detail are fully discussed. The purification devices used on the CEA piles are described. The purification operation is controlled continuously by means of industrial electrical conductivity meters and by periodic sampling, the samples being tested for the type and quantity of various impurities, as well as for the pH value. With regard to the decomposition of the water, information obtained on two CEA experimental piles is described. The radiolytic gases, carried by an inert gas, are recombined on classical catalyzers based on palladium. The apparatus used for this purpose is described and also the methods of measurement. Investigations of recombination circuits for power reactors are being carried out. The diluent used in this case is the vapor of the water itself. An experimental circuit (annex of a circuit used to study bursts in the canning, described elsewhere) has been constructed by the SOGREAH, for studying catalytic recombination at temperatures reaching 450°C at pres-

sures up to 160 kg/cm^2; the same circuit allows the study of the liquid phase recombination of gases in solution in the pressurized water. Results are given on the catalytic activity, generally excellent, and resistance to wear with time, in general much less satisfactory, of various contact masses. (auth)

16851 AECU-4189

Purdue Univ., Lafayette, Ind.

THE BETA DECAY OF Cd^{115m}. O. E. Johnson and W. G. Smith. [1959?]. 12p. $3.30(ph), $2.40(mf) OTS.

The decay of Cd^{115m} was studied by using NAI(Tl) scintillation counters and a 4π beta scintillation spectrometer. The following gamma rays were observed: 0.485 ± 0.007, 0.935 ± 0.014, 1.14 ± 0.017, and 1.29 ± 0.019 Mev. The 0.485- and 0.935-Mev gammas were found to be in coincidence. There were no gammas in coincidence with the 1.29-Mev gamma. The end point energy of the ground state beta transition was determined to be 1.631 ± 0.016 Mev. The shapes and end point energies of the beta groups in coincidence with the 0.935- and the 1.29-Mev gammas were measured. The former has a $\Delta I = 2$, yes, character, while the latter appears to have an allowed or statistical shape. The end point energies are 0.687 ± 0.008 Mev and 0.335 ± 0.010 Mev, respectively. (auth)

16852 AECU-4190

Kansas State Univ., Manhattan.

KINETICS OF THE EXCHANGE OF PHOSPHORUS IN PCl_3–$POCl_3$ SYSTEMS; EFFECT OF GAMMA RADIATION, ULTRAVIOLET LIGHT, VISIBLE LIGHT, HEAT AND TRACES OF WATER. LeRoy F. Grantham and Herbert C. Moser. Apr. 1959. 15p. Contract AT(11-1)-584. $3.30(ph), $2.40(mf) OTS.

The exchange of phosphorus between PCl_3 and $POCl_3$ has been measured with the use of P^{32} radioactive tracer. No exchange was found in this system for mixtures kept at 250°C in the presence of white light for 23 days. A detectable amount of exchange occurred in mixtures exposed to ultraviolet light. Hydrolysis products in the system enhanced the exchange. A gamma ray induced exchange was found to obey the equation, $M = k'bD + k''abD$, where M is the millimoles of phosphorus exchanged per gram of solution, a and b are the concentrations of PCl_3 and $POCl_3$ in millimoles per gram of solution, respectively, and D is the gamma ray dosage in rads. Values of k′ and k″ were found to be $(3.19 \pm 0.16) \times 10^{-10}$ rad^{-1} and $(4.24 \pm 0.31) \times 10^{-11}$ g millimole^{-1} rad^{-1}, respectively. The proposed mechanism for the second order exchange reaction consists of a P–O bond dissociation with subsequent recombination of the oxygen radical with PCl_3. The third order reaction can be explained by a gamma ray induced exchange of oxygen between weakly coupled PCl_3–$POCl_3$ dipoles or by the exchange of oxygen upon collision of excited PCl_3 or $POCl_3$ molecules with the other component in the system. (auth)

16853 HW-54913

General Electric Co. Hanford Atomic Products Operation, Richland, Wash.

MEASUREMENT OF I^{131} AND OTHER FISSION PRODUCTS ON VEGETATION BY GAMMA-RAY SPECTROMETRIC ANALYSIS. R. W. Perkins. Feb. 10, 1958. Decl. July 1, 1959. 53p. Contract W-31-109-Eng-52. $9.30(ph), $3.60(mf) OTS.

A procedure based on gamma-ray spectrometric analysis has been developed for the determination of I^{131} and several of the long-lived fall-out radioisotopes on vegetation. Quantitative analyses of I^{131}, $Ce^{141-144}$, $Ru^{103-106}$, Zr^{95}–Nb^{95}, and Ba^{140}–La^{140} are obtained from the measurement. It was possible to measure I^{131} (in the presence of existing levels of fall-out radioisotopes) with a sensitivity of about 1×10^{-6} μc/gm on a 150 gram sample by making a 10-minute measurement with a multichannel analyzer, 3 in. × 3 in. NaI(Tl) scintillation spectrometer. The procedure was somewhat less sensitive for the other radioisotopes. Experiments with larger samples and crystals indicated that the I^{131} sensitivity could be improved by a factor of two to three by doubling the sample size and using a larger, 3 in. × 5 in. diameter NaI(Tl) crystal. This latter sensitivity represents a 10 to 15 fold increase over that obtained with the former chemical separations technique. The concentration of the various radioisotopes in a vegetation sample are calculated from the photopeak counting rates in the gamma-ray spectrum, after making the necessary Compton corrections. The determination requires a ten minute counting measurement plus 10 to 15 minutes for disintegration rate calculations. For these short counting intervals the reproducibility appears to be about what one would predict from counting statistics. (auth)

16854 UCRL-8760

California. Univ., Berkeley. Lawrence Radiation Lab.

THE MEAN FISSION-FRAGMENT RANGE IN BISMUTH AS APPLIED TO PULSE-TYPE ION CHAMBERS (thesis). James W. Beasley. May 15, 1959. 33p. Contract W-7405-eng-48. $1.00(OTS).

Submitted to the United States Naval Postgraduate School. Monterey, Calif.

The mean effective fission-fragment range in bismuth has been measured in order that thickness efficiency corrections may be computed for bismuth-fission ion chambers. Parameters affecting pulse-height distributions, such as Bi thickness, collecting voltage, and gas-filling pressure, were varied in order that the best discrimination between fission pulses and spallation pulses could be attained. Six parallel-plate pulse-type ion fission chambers were used with bismuth thicknesses ranging from no bismuth to 5.83 mg/cm^2. The relative efficiencies of these chambers were compared by using 212-Mev neutrons from the 184-inch Berkeley cyclotron, and it was determined that the mean effective fission-fragment range was 4.30 ± 0.40 mg/cm^2 in bismuth. (auth)

16855 CEA-tr-R-643

ACTION DU RAYONNEMENT γ DU ^{60}Co SUR DES SOLUTIONS COLLOÏDALES HYDROPHOBES. (Effect of Co^{60} γ Radiation on Hydrophobic Colloidal Solutions.) V. F. Oreshko (Orechko), N. G. Serebryakov (Serebriakov), and E. K. Sakseev. Translated into French from Kolloid. Zhur. 17, 379-86(1955). 21p.

This paper was previously abstracted from the original language and appears in NSA, Vol. 10, as abstract No. 649.

16856

RADIOCHEMICAL SEPARATIONS OF CADMIUM. James R. DeVoe and W. Wayne Meinke (Univ. of Michigan, Ann Arbor). Anal. Chem. 31, 1428-32(1959) Aug.

Radiochemical separations of cadmium by solvent extraction with dithizone in basic media, by ion exchange in hydrochloric acid solution, and by two precipitation methods, one with an organic precipitant and

the other with a complex inorganic precipitant, have been developed, allowing a maximum time of separation of 30 minutes per method. These methods have also been critically evaluated for yield and contamination using 18 typical tracers. (auth)

16857

STUDY OF THE RADIOLYSIS OF BROMAL HYDRATE SOLUTIONS USING C^{14}-LABELLED BROMAL. H. Heusinger, R. J. Woods, and J. W. T. Spinks (Univ. of Saskatchewan, Saskatoon, Can.). Can. J. Chem. 37, 1127-31(1959) July.

Bromal labelled with C^{14} in the carbonyl group has been used to show that small amounts of carbon dioxide and carboxylic acids are produced in the radiolysis of aqueous bromal solutions. G values for the production of CO_2 and carboxylic acid are about 7.5% and 15% of those for HBr production, respectively. The observed yield of carboxylic acid is in agreement with that found by titration. (auth)

16858

RADIATION-INDUCED ADDITION OF HBr TO C_2H_4 IN THE GASEOUS STATE. D. A. Armstrong and J. W. T. Spinks (Univ. of Saskatchewan, Saskatoon, Can.). Can. J. Chem. 37, 1210-24(1959) July.

The gas phase addition of hydrogen bromide to ethylene in a pyrex irradiation cell was induced by the action of Co^{60} γ rays. Dose rates were calculated by means of the Bragg–Gray cavity principle from saturation ionization currents measured in air in a similar cell. The only product detected was ethyl bromide and the ion pair yield was of the order of 10^5. The rate of addition was followed with an electrically adjusted "spoon gauge" and was studied (a) with HBr in great excess, (b) with HBr and C_2H_4 in equal concentration, (c) with C_2H_4 in great excess. For condition (a) the rate showed a first-order dependence on $[C_2H_4]$, an approximate second-order dependence on [HBr], a negative temperature coefficient, and a dose rate exponent of unity. It was concluded that the reaction rate was determined by the same step as for the photobromination reaction and that wall termination predominated. For conditions (b) and (c) the dose rate exponent was found to be approximately 0.5 indicating a predominance of mutual termination. Definite conclusions with regard to the termination reaction were not possible but the data suggested that certain ion-molecule reactions may precede ion combinations. (auth)

16859

DETERMINATION OF URANYL NITRATE IN FREE NITRIC ACID BY MEANS OF ACIDIMETRIC TITRATION. J. Cepelák, J. Malý, and V. Veselý (Tschechoslowakische Akademic der Wissenschaften, Prague). Collection Czechoslov. Chem. Communs. 24, 1723-5 (1959) May. (In German)

A method based on the quantitative reaction of uranyl nitrate with hydrogen peroxide to release nitric acid is presented for the determination of uranyl nitrate in nitric acid solution. The hydrogen peroxide is added to the uranyl nitrate solution and the total nitric acid determined by visual or potentiometric titration with sodium hydroxide. The free nitric acid is determined by titration of the solution without the addition of hydrogen peroxide. The difference in the consumption of sodium peroxide corresponds to the uranyl nitrate present. (J.S.R.)

16860

THE DETERMINATION OF THE RADIUM CONTENT IN RADIUM COMPOUNDS. G. V. Gorshkov, F. M. Karavayev, and N. S. Shimanskaya. Izmeritel'naya Tekh. No. 3, 52-3(1959).

Ionization methods are generally used for the determination of the radium content of radium compounds. The accuracy of contemporary ionization methods for this determination is investigated using the Russian standards X and XI. The results show that the difference in the gamma self-absorption in 15 mg $RaCl_2$ and 150 mg $RaBr_2$ is large. The effective self-absorption in standard XI is 0.9% and 1.7% in 150 mg $RaBr_2$. The establishment of new standards with a radium content of 1, 5, 10, 25, 100, 200, and 500 mg is recommended for the USSR. In the absence of new standards, a formula is given for obtaining an accuracy of 0.3 to 0.5%. (J.S.R.)

16861

CERIC REDUCTION AND THE RADIOLYTIC HYDROGEN YIELD. H. A. Mahlman (Oak Ridge National Lab., Tenn.). J. Am. Chem. Soc. 81, 3203-4(1959) July 5.

The hydrogen yields observed in the cobalt-60 γ-ray irradiation of sulfuric acid solutions of ceric ions indicate an acid independence to 0.8 M H_2SO_4. The suppressive action of the solute may be expressed by the equation $G(H_2) = -0.21[Ce^{IV}]^{\frac{1}{2}} + 0.44$. The scavenging effect of ceric ion indicates that the theoretical cerous yield may be obtained only in infinitely dilute ceric solutions. (auth)

16862

A COMPARISON OF THE DECOMPOSITION OF HEXANE AND CYCLOHEXANE BY DIFFERENT TYPES OF RADIATION. Harold A. Dewhurst and Robert H. Schuler (General Electric Research Lab., Schenectady, N. Y. and Brookhaven National Lab., Upton, N. Y.). J. Am. Chem. Soc. 81, 3210-12(1959) July 5.

Hexane and cyclohexane have been irradiated with radiations having energy loss parameters from 0.02 to 5 ev/A, and the liquid products have been examined by gas chromatographic and infrared methods. In this preliminary study no change in over-all decomposition is observed which can be attributed directly to a variation in the linear energy transfer of the radiation. (auth)

16863

THE DECOMPOSITION OF NEOPENTANE UNDER ELECTRON IMPACT. F. W. Lampe and F. H. Field (Humble Oil and Refining Co., Baytown, Tex.). J. Am. Chem. Soc. 81, 3238-41(1959) July 5.

Appearance potentials are reported for the formation by electron impact of these various ions from neopentane: t-$C_4H_9^+$, $C_3H_5^+$, $C_3H_3^+$, $C_2H_5^+$, $C_2H_3^+$, and CH_3^+. Where possible ionization processes and/or heats of formation are deduced. The heat of formation of t-$C_4H_9^+$ is found to be 179 kcal/mole, which disagrees with the heretofore accepted value. The heat of formation of t-butyl radical is found to be about 2 kcal/mole, which agrees with published values within the limits of our experimental accuracy. The new ΔH_f(t-$C_4H_9^+$) value is used to make a re-interpretation of the previously published value of the appearance potential of t-butyl ion from 3,3-dimethyl-1-butene, and from the re-interpretation one can deduce for the quantities $\Delta H_f(C_2H_3)$ and $D(C_2H_3-H)$ the values 68 and 107 kcal/mole, respectively. The evidence concerning the neopentane decomposition modes provided by metastable ions is considered, and it is found that the metastable ion evidence and appearance potential evidence for the reactions producing the mass 27 and 39 ions are not in agreement. A

discussion of the possible origins of the disagreement is given. (auth)

16864

MEASUREMENT OF THE RECOMBINATION OF H AND OH IN γ-IRRADIATED AQUEOUS SYSTEMS. Thomas J. Hardwick (Atomic Energy of Canada Ltd., Chalk River, Ont.). J. Chem. Phys. 31, 226-31(1959) July.

Differences in radical and molecular yields in γ-irradiated light and heavy water solutions have been measured over the range of sulfuric acid concentration 0 to 0.8N. Three new terms have been defined: G_H* and G_{OH}*, which represent the hydrogen atoms and hydroxyl radicals whose fate is to recombine to reform water; G_{-H_2O}, which represents the gross number of water molecules decomposed into radicals. A model of radical formation and diffusion has been developed from which values of G_H*, G_{OH}*, and G_{-H_2O} may be calculated from the experimental data. (auth)

16865

ABSOLUTE DOSIMETRY FOR X RAYS WITH AN AVERAGE ENERGY OF 23 kv. STANDARDIZATION OF FERROUS SULFATE. Marcel Frilley and Marc Lefort (Laboratoire Curie, Paris and Laboratoire de Physique Nucléaire d'Orsay). J. phys. radium 20, 516-18(1959) May. (In French)

The dose rate from an x-ray beam generated by a tin anode in an x-ray tube operating under 100 kv was measured with an absolute ionization chamber. The yield of oxidized ferrous sulfate in aqueous sulfuric acid solutions was determined. For an effective mean energy of 23 kev, the value of 15.1 ± 0.5 ions oxidized for 100 ev was found, a figure slightly smaller than with radiocobalt γ rays. The dependence of this yield on the energy of the electrons is discussed. (auth)

16866

EFFECTS OF GAMMA RAYS ON AQUEOUS SOLUTION OF POLYVINYL ALCOHOL. Osamu Saito (Chuo Univ., Tokyo). J. Phys. Soc. Japan 14, 792-7(1959) June.

The general treatment developed in previous papers is applied to the case where the aqueous solution of polyvinyl alcohol is irradiated by gamma rays, and the results are compared with Danno's measurements. The behaviors of irradiated aqueous solution of polyvinyl alcohol before and after gelation are well explained by the author's general theory. It is concluded from the analysis that end-linking instead of cross-linking occurs in the solution, also that only one molecular end out of the two, which are produced by molecular scission of a polymer, links with a monomer unit of another polymer molecule. It is also shown that if any impurity, especially oxygen, is not contained, the intrinsic viscosity of polyvinyl alcohol increases with radiation dose. (auth)

16867

EFFECT OF IMPURITY ON MOLECULAR LINKING OF IRRADIATED POLYMER. Osamu Saito (Chuo Univ., Tokyo). J. Phys. Soc. Japan 14, 798-806(1959) June.

The effect of impurity on cross-linking or end-linking of an irradiated polymer is discussed theoretically. It is shown that the radiation effect on a pure polymer can be found by measuring the intrinsic viscosity and the gel point of an irradiated polymer containing an impurity. The theory is compared with Chapiro's measurements. One of the important results is that when impurity hinders cross-linking, all the relations between physical quantities of an irradiated polymer containing impurity can be reduced to those of the polymer containing no impurity, if use is made of a reduced radiation dose instead of the real dose. This is not the case for the effect of impurity on end-linking. Such a difference is expected to enable one to distinguish between cross-linking and end-linking. (auth)

16868

DETERMINING Sr 90 in SOIL BY ELECTRODIALYSIS AND ION EXCHANGE METHOD. Ellis R. Graham (Los Alamos Scientific Lab., N. Mex.). Soil Sci. 88, 11-15 (1959) July.

A procedure is given for the electrodialysis of soil and the radiochemical determination of Sr-90 in the soil extract. The soil is electrodialyzed for a period of 12 hours and the resulting soil extract is treated with EDTA, pH adjusted to 5.5, and placed over a resin (Dowex 50 × 12) column. The Y-90 is reduced to zero by elution with EDTA citric acid solution. After a period of time for the ingrowth of Y-90, the ingrown Y-90 is milked with citric acid and the Y-90 precipitated as a fluoride for filtration and counting. For soil samples that have been treated with salt forms of Sr-90, the yield is better than 96 per cent. (auth)

Separation Processes for Pu and U

16869 ANL-5996

Argonne National Lab., Lemont, Ill.

CHEMICAL ENGINEERING DIVISION SUMMARY REPORT [FOR] JANUARY, FEBRUARY, MARCH 1959. June 1959. 270p. Contract W-31-109-eng-38. $4.00 (OTS).

Chemical-Metallurgical Processing. A direct-cycle fuel reprocessing plant is being designed for pyrometallurgical processing of discharged power reactor fuel elements. Irradiation tests on cerium-bearing glass samples for shielding windows revealed that the optimum cerium content is less than the nominal amount originally specified. The light output of gamma-irradiated mercury vapor lamps was determined to be about 55% of original after an exposure of 1.1×10^9 rads. Analyses of the composition of 30 ten-kilogram ingots of natural U–5% fissium alloy prepared in the melt-refining furnace indicate that not all of the added Zr and Mo went into solution. Irradiation tests have shown that natural rubber formulated with an antioxidant (Antiox 4010) is satisfactory for cable insulation at radiation levels to 2×10^8 rads. Four 2-kilogram scale runs were made to study the melt-refining characteristics of high Pu (20%)–U–fissium alloys. A further investigation was made of the possible Zr contamination of molten U and its Ce alloy resulting from prolonged holding at 1400°C in stabilized ZrO_2 crucibles. Experiments at 1700°C showed considerable evolution of CO as a result of reaction of ZrO_2 with graphite. Reduction of oxide coatings on U fuel pins by Mg in Zn solution continues to be promising. Studies were continued on the processing of melt-refining residues. Engineering techniques are being developed and evaluated for the various liquid metal processes under consideration. Further evidence of attack of Ta by Zn at 800°C is reported. In 100-hour tests at 550°C, Cd containing up to 10% Zn did not corrode mild steel. The solubilities of La, Pd, Zr, and

Mo in liquid Cd were measured. The Pd and Zr solubilities were also examined for U-saturated Cd solutions. The solubility of U in Cd–Zn, Cd–Hg, Cd–Mg, and Zn–Mg alloys was investigated. The coefficient for the coprecipitation of Pu with U from Cd solutions is 0.67. The preparation of a high-purity sample of each of two forms of molybdenum sulfide was completed. Fuel Cycle Applications of Volatility and Fluidization Techniques. In connection with the reprocessing of reactor fuels by combined fluidization-volatility processes, the fluorination rates of UF_4 by mixtures of fluorine and helium were investigated. Additional studies were made of the effect of ADF process variables on the recovery of U from U–Zr and Zircaloy-2 fuel alloys. Batch fluid-bed fluorinations of fluid-bed dried material were made in the $2\frac{1}{2}$-inch diameter unit at 500°C. Development work continued on a high-temperature fused-salt process for the recovery of enriched U from Zr matrix fuel alloys. The exchange of Zr between irradiated Zr dissolved in Bi and molten fused fluoride salt, as well as the extent of the extraction of Zr and Nb by the fused salt, is demonstrated. Additional data are reported from the operation of the fluid-bed waste calciner, used to convert liquid wastes to granular solids. Feasibility studies have started on the direct continuous conversion of UF_6 to UO_2 by reaction with steam and hydrogen in a $1\frac{1}{2}$-inch diameter fluidized bed. The planned series of experiments on the mixing of solids in straight- and tapered-wall fluid-bed columns using a radioactive tracer technique was completed. Reactor Safety. In the studies of the rate of propagation of burning along U foils, a large number of surface contaminants have been shown to have no effect or to slow the burning process in air. The experimental program to determine rates of reaction of molten reactor fuel and cladding metals with water is continuing. Reactor Chemistry. Studies on the decontamination of boiling water reactors are reported. (For preceding periods see ANL-5959.) (W.L.H.)

16870 CF-59-1-9(Rev.1)
Oak Ridge National Lab., Tenn.
EUROCHEMIC ASSISTANCE: ANALYTICAL—ANSWERS TO SPECIFIC QUESTIONS. L. T. Corbin. July 14, 1959. 7p. Contract W-7405-eng-26. $1.80 (ph), $1.80(mf) OTS.

The spectrochemical, carrier distillation, liquid-liquid extraction, and ion exchange of plutonium are discussed. (W.L.H.)

16871 CF-59-3-95(Rev.)
Phillips Petroleum Co. Atomic Energy Div., Idaho Falls, Idaho and Oak Ridge National Lab., Tenn.
EUROCHEMIC ASSISTANCE PROGRAM: COMMENTS BY ICPP, DATED MARCH 17, 1959, ON QUESTIONS FOR EUROCHEMIC. M. E. Weech. Mar. 26, 1959. 5p. $1.80(ph), $1.80(mf) OTS.

Comments by ICPP personnel on questions posed by Eurochemic Company are presented. Included is information on a fumeless dissolution system, recycle and rework system, liquid waste storage, criticality, in-line instrumentation, and a report listing Idaho Operations Area costs. (J.R.D.)

16872 CF-59-5-1
Oak Ridge National Lab., Tenn.
EUROCHEMIC ASSISTANCE: CHEMICAL TECHNOLOGY DIVISION UNIT OPERATIONS SECTION MONTHLY PROGRESS REPORT, NOVEMBER 1958. (SECTIONS 1.0, 5.0, 6.0, AND 8.0 OF ORNL CF-58-11-93). E. M. Shank. May 1, 1959. 28p. Contract W-7405-eng-26. $4.80(ph), $2.70(mf) OTS.

The extraction reaction kinetics and the liquid diffusivities are being studied by measuring the concentration profile in a column of liquid containing an interface. The determination of the equilibrium sorption isotherms and rates of sorption of U on Dowex 21K is reported. Flowsheet development and modification are reported for the Darex process. It was shown that the hydrochlorination of Zr–U alloy fuels with HCl gas containing CO_2, H_2O, and O_2 impurities increases the quantity of HNO_3 insoluble U losses in the uranium chloride product. During the dissolution of spent enriched oxide fuel cores in a dissolver geometrically safe only in the bottom dissolution area, the dissolution off-gas may entrain critical amounts of fine undissolved fuel particles to the enlarged non-critically safe upper portion of the dissolver. Preliminary tests were made to determine the likelihood of fuel fines being entrained in this manner during the dissolution. Solvent extraction studies are being made to assist the Hanford Atomic Products Operation to adapt the Redox process for the recovery of U from spent stainless steel-type power reactor fuels. Preliminary hot cell tests of the Zirflex and Sulfex flowsheets were completed. Batch dejacketing and core dissolution of each of sixteen PWR blanket fuels (UO_2 pellets clad with Zircaloy-2) with burnups from 250 to 2500 Mwd/ton were made. A series of experiments was made to determine the amount of fission products evolved when different types of wastes were calcined to dryness. (W.L.H.)

16873 CF-59-5-2
Oak Ridge National Lab., Tenn.
EUROCHEMIC ASSISTANCE: CHEMICAL TECHNOLOGY DIVISION UNIT OPERATIONS SECTION MONTHLY PROGRESS REPORT, DECEMBER 1958. (SECTIONS 5.0, 6.0, 8.0). E. M. Shank. May 1, 1959. 27p. Contract [W-7405-eng-26]. $4.80(ph), $2.70(mf) OTS.

A study of the equilibrium sorption isotherms and rates of U sorption on Dowex 21K is in progress. Data which show the effects of uranium concentration in solution on resin loading are presented. Fuel reprocessing experiments are reported in which efforts were made to reduce Cl^- in Darex dissolver solution to < 350 ppm for the extraction phase. The best method of Cl^- reduction appears to be operation with a down draft condenser and an air sparge. A check-out dissolution run in the 6 in. glass dissolver with a prototype APPR fuel element is reported, and data on dissolution time and composition of reacted products are given. Data on filtration rates for Darex solutions expected in large-scale operations are tabulated, and graphs illustrating the effects of pressure drop and filter aids on filtering rates are presented. Tests on washing U from filter cakes indicate that U can be removed to any desired level. Viscosity, density, and boiling points as a function of temperature or pressure were determined for two Darex solvent extraction feed solutions; data are presented graphically, and results of chemical analyses are tabulated. Demonstration runs for Sulfex and Zirflex dejacketing flowsheets were made. Results indicate that parts of the Sulfex flowsheet may have to be changed to prevent core losses from fluoride contamination. Results from the Zirflex demonstration are being compiled. Design of the SRE decanning device was completed and sub-

mitted to vendors for bids; also the design of a prototype fuel bundle to serve as an inexpensive substitute in chopping and leaching studies is reported. Preliminary shearing studies with the 120 ton hydraulic Manco shear indicate that its usefulness is limited, and criteria for a large shear for spent fuel bundles are being written. Darex-type solvent extraction studies using hexane are reported, and U loss data are tabulated. Several experiments to determine the amount of fission products evolved when various types of wastes were dried and calcined are reported. The amount of fission products in the condensate and the amount removed by the caustic scrubber downstream of the condensate receiver are given. (For preceding period see CF-59-5-1.) (J.R.D.)

16874 CF-59-5-3
Oak Ridge National Lab., Tenn.
EUROCHEMIC ASSISTANCE: MONTHLY PROGRESS REPORT FOR CHEMICAL DEVELOPMENT SECTION B, JANUARY 1959. (SECTIONS 1.0, EXCEPT 1.42, AND 2.0). E. M. Shank. May 1, 1959. 27p. Contract W-7405-eng-26. $4.80(ph), $2.70(mf) OTS.

An effort is being made to determine the equilibrium sorption isotherms and rates of sorption of U on the anion exchange resin Dowex 21K. In the Darex process investigations included: batchwise Cl^- removal and feed adjustment, continuous dissolution, feed clarification, filtration rates for solutions, effect of pressure drop and filter aid on filtration rate, cake washing and removal, properties of solutions, and properties of sands and filter aids. Batch dissolutions of irradiated Consolidated Edison Fuel and PWR blanket pins were made to demonstrate the Sulfex and Zirflex dejacketing flowsheets, respectively. Dissolution studies to obtain rate and penetration data for UO_2 in HNO_3 solutions were begun. Preliminary shearing studies with the 120 ton hydraulic Manco shear with a prototype fuel bundle showed that a line contact shear closes the fuel bearing tubes to an extent detrimental to good leaching. A series of experiments was performed to determine the amount of fission products evolved when different types of wastes were dried and calcined. (W.L.H.)

16875 CF-59-6-73
Oak Ridge National Lab., Tenn.
POWER REACTOR FUEL REPROCESSING PROCESS WASTES. W. L. Conger. June 19, 1959. 7p. Contract [W-7405-eng-26]. $1.80(ph), $1.80(mf) OTS.

Data on waste volumes and heat generation of several reactor fuels which may be reprocessed in the Power Reactor Fuel Reprocessing Pilot Plant at ORNL are tabulated. (auth)

16876 CF-59-6-111
Oak Ridge National Lab., Tenn.
ESTIMATE OF POTENTIAL FUEL REPROCESSING, REVISION NO. 28—PART A. J. W. Ullmann. June 25, 1959. 9p. Contract [W-7405-eng-26]. $1.80(ph), $1.80(mf) OTS.

A tabulation containing information on the power of existing and proposed U. S. and U. S.-built reactors of 10 kw or greater thermal power is presented. Estimated fuel reprocessing loads for irradiated fuels are also included. (auth)

16877 CNI-8
Italy. Comitato Nazionale per le Ricerche Nucleari. Centro Nazionale per le Ricerche Nucleari, Ispra.
DETERMINAZIONE QUANTITATIVA DEL CONTENUTO IN URANIO-238 DI POLVERI DI LABORATORIO METALLURGICO. (Quantitative Determination of the Uranium-238 Contents of Dusts of a Metallurgical Laboratory.) A. M. Del Turco, G. Restelli, and O. Terracini. Feb. 1959. 9p.

Chemical and physical methods were used to examine powders from a uranium metallurgical laboratory. The chemical method consisted of the dissolution of the powder in nitric acid and extraction of the uranium with TBP. A qualitative analysis of the powder was made using an ionization chamber and a 4π counter. The 4π counter was then used for a quantitative determination of U^{238}. The powder was 61 wt.% U^{238} (J.S.R.)

16878 HW-60116
General Electric Co. Hanford Atomic Products Operation, Richland, Wash.
DESCRIPTION OF PUREX PLANT PROCESS. E. R. Irish. Apr. 30, 1959. Decl. May 19, 1959. 16p. Contract [W-31-109-Eng-52]. $3.30(ph), $2.40(mf) OTS.

A brief summary, with reference literature for details, of pertinent and important process flowsheet conditions which are in use in the Purex Process is presented. (auth)

16879 HW-60281(Del.)
General Electric Co. Hanford Atomic Products Operation, Richland, Wash.
EUROCHEMIC INFORMATION EXCHANGE—ANSWERS TO SPECIFIC QUESTIONS. O. F. Hill. May 5, 1959. 17p. Contract W-31-109-Eng-52. $3.30(ph), $2.40(mf) OTS.

Answers to specific questions posed in relation to the Eurochemic processing plant are presented. The questions and information in the answers are largely in regard to Purex-type operation. Questions on extraction column details, TBP stability, use of elevated temperatures in the Purex Process, specifications for column plates, off standard streams and products, waste disposal, and others are included. (J.R.D.)

16880 NP-7656
European Company for the Chemical Processing of Irradiated Fuels, Mol, Belgium.
PRACTICAL CONSIDERATIONS ON THE DECANNING AND THE DISSOLUTION OF ALUMINUM- OR MAGNESIUM-CLAD ELEMENTS. Technical Report No. 26. E. Detilleux. Dec. 4, 1958. 21p. $4.80(ph), $2.70(mf) OTS.

Data in various reports indicate that it is possible to process Al- and Mg-clad fuel elements in the same vessel. The conditions of such an operation are considered, and proposed chemical flowsheets are presented. Treatment of Al-clad elements are discussed, and operational procedures are presented in tabular form. Small changes in the Al-clad element procedure for use with Mg-clad elements are pointed out. The apparatus flowsheet resulting from this study is presented in TR-25. (J.R.D.)

16881 NP-7657
European Company for the Chemical Processing of Irradiated Fuels, Mol, Belgium.
USE OF AIR LIFTS AS METERING APPARATUS FOR RADIOACTIVE MATERIALS: DESIGN FOR CONSTRUCTION OF AN EXPERIMENTAL UNIT. Technical Report No. 27. A. Redon. Dec. 16, 1958. 30p. $6.30(ph), $3.00(mf) OTS.

The first part of this document reflects a study of G. W. T. Kearsley, "Use of an Air Lift as a Metering Pump for Radioactive Solutions," ORNL-2175. The second part is devoted to an examination of the results

found and to discussion of construction of an experimental unit. Drawings of equipment which were not in the above mentioned report are included. (W.L.H.)

16882 NP-7658
European Company for the Chemical Processing of Irradiated Fuels, Mol, Belgium.
GENERAL SAFETY FACTORS FOR A NUCLEAR FUEL REPROCESSING PLANT. PART 1. NUCLEAR SAFETY. PART 2. RADIATION SHIELDING. PART 3. CHEMICAL SAFETY PROBELMS. Technical Report No. 2. Alf Larsson. Dec. 12, 1957. 15p. $3.30(ph), $2.40 (mf) OTS.

Nuclear safety in a fuel reprocessing plant is discussed. Means of avoiding criticality such as mass limitation, safe geometry, and safe concentrations are examined along with a note of caution on reflection. In addition, shielding is discussed, and it is pointed out that major pieces of equipment must be heavily shielded especially at the head-end of the process. Designs based on maximum permissible dose rates are described, and recommendations for minimizing radiation are presented. Also, chemical safety aspects are considered including processes which involve toxic and irritant chemicals and those which involve inflammable or explosive materials. Several chemicals are listed according to their hazardous properties, and examples are given of the results of poor safety procedures. An outline of hazards to be avoided is also presented. (J.R.D.)

16883 NP-7659
European Company for the Chemical Processing of Irradiated Fuels, Mol, Belgium.
SUGGESTED ORGANIZATION AND WORK DURING THE INTERIM PERIOD. Report B. Jan. 18, 1958. 14p. $3.30(ph), $2.40(mf) OTS.

Changes are recommended in the earlier plan of tasks to be undertaken during the interim period by the study group because of the current decision to locate the Eurochemic plant at Mol, Belgium. Some research work can start immediately, and an over-all interim plan is outlined. Details of the plans are presented under administrative, technical, and research planning. Also included are plans for organization of an interim staff and provision for a small library. (J.R.D.)

16884 NP-7660
European Company for the Chemical Processing of Irradiated Fuels, Mol, Belgium.
BIBLIOGRAPHY OF REPORTS ON PLUTONIUM PROCESSING. Technical Report No. 3. A. Norström. Mar. 24, 1958. 24p. $4.80(ph), $2.70(mf) OTS.

A bibliography on Pu processing is presented. References concerning various aspects of processing such as head-end treatment, chemical processing, buildings, equipment, instrumentation, public health aspects, economy, and analysis are included. About 400 references. (J.R.D.)

16885 NP-7661
European Company for the Chemical Processing of Irradiated Fuels, Mol, Belgium.
TAIL-END TREATMENTS FOR URANIUM AND PLUTONIUM CONCENTRATION AND PURIFICATION. Technical Report No. 4. M. Zifferero. May 16, 1958. 28p. $4.80(ph), $2.70(mf) OTS.

Uranium and plutonium products from a Purex-type flowsheet to be tail-end treated are discussed. A survey is presented of the methods so far applied or proposed in the field of tail-end treatments with the emphasis on silica gel U purification, and ion exchange Pu concentration and purification. Also a program for testing procedures and materials is outlined. (J.R.D.)

16886 NP-7662
European Company for the Chemical Processing of Irradiated Fuels, Mol, Belgium.
PRELIMINARY DRAFT OF STUDIES ON PILOT PLANT EXTRACTION. Technical Report No. 5. A. Redon. May 16, 1958. 14p. $3.30(ph), $2.40(mf) OTS.

The preliminary design of a Purex-type U extraction and stripping pilot plant, together with methods for concentration and solvent recovery of U, were examined. Conclusions concerning construction materials can be drawn from the pilot plant data, and flowsheets for industrial scale operation can be verified from laboratory scale experiments. The study includes only basic characteristics of plant equipment. More detailed study of each point is required before final decisions can be reached. (J.R.D.)

16887 NP-7663
European Company for the Chemical Processing of Irradiated Fuels, Mol, Belgium.
PRELIMINARY WORKING PROGRAM FOR THE DEVELOPMENT OF ANALYTICAL METHODS FOR THE EUROCHEMIC REPROCESSING PLANT, 1958. Technical Report No. 6. K. Samsahl. May 16, 1958. 11p. $3.30(ph), $2.40(mf) OTS.

A summary of the analytical work to be carried on by shifts in the Eurochemic plant is presented. The basis for the analytical methods is existing literature. An experimental program is suggested for evaluating the various selected procedures. Some of the analytical instruments to be used in the plant are described. (J.R.D.)

16888 NP-7664
European Company for the Chemical Processing of Irradiated Fuels, Mol, Belgium.
LABORATORY INSTALLATION FOR STUDY OF DECONTAMINATION AND SEPARATION OF URANIUM AND PLUTONIUM FROM A SOLUTION PRODUCED BY DISSOLUTION OF IRRADIATED URANIUM. Technical Report No. 7. E. Hoffmann. May 16, 1958. 13p. $3.30(ph), $2.40(mf) OTS.

A summary of the experiments to be undertaken, the apparatus, and the laboratory arrangement for preliminary studies on the Eurochemic reprocessing plant for irradiated fuels is given. Maximum personnel safety is emphasized from the standpoint of radiation and atmospheric non-radiative contaminants. Cost estimates are tabulated, and building layouts are diagrammed. (J.R.D.)

16889 NP-7665
European Company for the Chemical Processing of Irradiated Fuels, Mol, Belgium.
HEAD END PROCESS. PART 1. REVIEW OF THE LITERATURE. PART 2. PROPOSAL FOR LABORATORY SCALE DISSOLUTION UNITS. Technical Report No. 8. E. Detilleux. May 16, 1958. 19p. $3.30(ph), $2.40(mf) OTS.

A literature survey on head-end operations for liquid-liquid extraction of irradiated fuels was conducted. A study of the third and fourth operations for natural or slightly enriched fuel elements containing Al, Zr, Mg, and stainless steel is emphasized. Purex-type flowsheets for fuel dejacketing and dissolution are given along with an examination of clarification and adjustment of solutions. Also the design of a fumeless dissolution installation for laboratory use is described and diagrammed. (J.R.D.)

16890 NP-7666

European Company for the Chemical Processing of Irradiated Fuels, Mol, Belgium.

COST ESTIMATION FOR THE EXTRACTION PILOT PLANT. Technical Report No. 9. A. Redon. June 27, 1958. 7p. $1.80(ph), $1.80(mf) OTS.

The first approximation of the necessary investments in the extraction pilot plant which is outlined in Report No. 5 dated May 16, 1958, are presented. The pilot plant is planned for a room in the waste disposal facility. Detailed costs are listed, and a recommendation for additional amounts for an operating budget is included. (J.R.D.)

16891 NP-7667

European Company for the Chemical Processing of Irradiated Fuels, Mol, Belgium.

CRITICAL SURVEY ON ALTERNATIVE PROCESSES IN AQUEOUS REPROCESSING OF IRRADIATED URANIUM. Technical Report No. 10. Sten Ahrland. Aug. 6, 1958. 8p. $1.80(ph), $1.80(mf) OTS.

Alternative procedures for U in the Eurochemic fuel reprocessing plant are surveyed. Choice of scrub solutions are considered as well as decontamination cycles, partition cycles, tail end treatment, amine substitution for TBP, and substitution of extraction steps by sorption steps. It is concluded that additional information on several listed points is desirable before a decision is made. (J.R.D.)

16892 NP-7668

European Company for the Chemical Processing of Irradiated Fuels, Mol, Belgium.

PROGRAM FOR PRELIMINARY SOIL INVESTIGATION. Technical Report No. 11. Ernst Lüscher. Aug. 21, 1958. 3p. $1.80(ph), $1.80(mf) OTS.

Plans for investigation to obtain information about underground and ground water at the Eurochemic site are presented. Requirements of the investigation include geological evaluation of the area, information on mechanical properties of the local soil, and data on the water, such as composition, quantity, and direction of flow. (J.R.D.)

16893 NP-7669

European Company for the Chemical Processing of Irradiated Fuels, Mol, Belgium.

PRELIMINARY PLANS FOR CONSTRUCTION OF REPROCESSING PLANT. Technical Report No. 12. E. Hoffmann, E. Betilleux, A. Redon, and M. Zefferero. July 21, 1958. 23p. $6.30(ph), $3.00(mf) OTS.

The preliminary draft of a plan based on a Purex-type flowsheet for the Eurochemic plant is presented. The construction diagram is a compromise between flowsheets which were investigated. The over-all flowsheet was developed from various considerations pertaining to the decontamination, purification, and separation of Pu and U. It specifies the final plant construction materials and provides for solvent purification and HNO_3 recovery. Also, tentative effluent treatment procedures are included. (J.R.D.)

16894 NP-7670

European Company for the Chemical Processing of Irradiated Fuels, Mol, Belgium.

SPECIFICATIONS FOR THE EQUIPMENT OF A PILOT EXTRACTION ASSEMBLY. Technical Report No. 13. A. Redon. July 31, 1958. 12p. $3.30(ph), $2.40(mf) OTS.

See also Technical Report No. 5 (NP-7662).

Specifications for the equipment of a pilot extraction assembly are presented. The various specifications will serve as a basis for scale-up studies, and those proposed for control and measuring equipment should allow for a choice among commercial types. Chemical and physical conditions are recommended for concentration of uranyl nitrate solutions after the stripping column. For the radioactive liquid circuits (U circuits) metallic bellows-sealed cocks or valves are recommended. (J.R.D.)

16895 NP-7671

European Company for the Chemical Processing of Irradiated Fuels, Mol, Belgium.

MATERIAL BALANCE. Technical Report No. 14 (Rev.). E. Hoffman, M. Zifferero, A. Redon, and E. Detilleux. Dec. 30, 1958. 18p. $3.30(ph), $2.40(mf) OTS.

A review of TR-14 based on an extraction rate of 66.6 l/hr is presented. The remarks on activity calculations at the beginning of TR-23, which is a supplement to TR-14, are valid for the discussions and calculations included in this revision. Material balances are established for U and Pu. (J.R.D.)

16896 NP-7672

European Company for the Chemical Processing of Irradiated Fuels, Mol, Belgium.

RECENT DEVELOPMENTS IN AQUEOUS REPROCESSING OF IRRADIATED URANIUM. Technical Report No. 15. Sten Ahrland. Oct. 1, 1958. 12p. $3.30(ph), $2.40(mf) OTS.

See also Technical Report No. 10 (NP-7667).

A summary of recent developments in aqueous reprocessing of irradiated U is presented. General trends are discussed as well as recent work on dual-temperature scrub and extracting agents such as amines. In addition, a discussion of organic ion exchangers for Pu tail-end treatment is presented along with the use of inorganic ion exchangers such as silica gel and other hydrous oxides for Pu and U separations. Consideration is also given to substituting U(IV) for Fe(II) as a reducing agent for Pu(IV), and the possibility of decreasing the number of extraction cycles is examined. It is suggested that the dual-temperature scrub merits closer investigation as does waste recycling, anion exchange purification of Pu, and the use of amines as extracting agents. (J.R.D.)

16897 NP-7673

European Company for the Chemical Processing of Irradiated Fuels, Mol, Belgium.

ANALYTICAL PROCEDURES FOR THE EUROCHEMIC REPROCESSING PLANT. Technical Report No. 16. K. Samsahl. Oct. 10, 1958. 34p. $6.30(ph), $3.00(mf) OTS.

A detailed analytical flowsheet for the Eurochemic reprocessing plant is presented. Information in Eurochemic Technical reports 12 and 14 is the basis for these procedures which are thought to be valid for the first 6 months of operation. Simplified procedures can probably be used after the initial period. Analytical procedures for recovered solvent and acids are not included but will be added when the process flowsheets for the solvent recovery system have been worked out. (J.R.D.)

16898 NP-7674

European Company for the Chemical Processing of Irradiated Fuels, Mol, Belgium.

PRELIMINARY FUNCTIONAL PLANNING AND LAYOUT OF THE EUROCHEMIC RESEARCH LABORATO-

RIES. Technical Report No. 17. W. Schüller. Oct. 10, 1958. 20p. $4.80(ph), $2.70(mf) OTS.

A summary of the functional planning and layout of the Eurochemic research laboratories is presented. Principal lines of research effort are discussed emphasizing process development. Laboratory organization and room requirements are considered, and a functional plan is presented. (J.R.D.)

16899 NP-7675

European Company for the Chemical Processing of Irradiated Fuels, Mol, Belgium.

DESIGN CAPACITY OF THE EUROCHEMIC REPROCESSING PLANT. Technical Report No. 18. E. Hoffmann, E. Detilleux, and O. Jenne. Oct. 24, 1958. 7p. $1.80(ph), $1.80(mf) OTS.

The design capacity of the Eurochemic reprocessing plant is examined. Predicted loads of materials to be processed are discussed along with other factors such as maintenance down-time. It was decided that 150 days per year of extractive operation should be scheduled to handle 100 tons of irradiated fuel. (J.R.D.)

16900 NP-7676

European Company for the Chemical Processing of Irradiated Fuels, Mol, Belgium.

PLAN FOR A PILOT SCALE LIQUID-LIQUID EXTRACTION UNIT. Technical Report No. 19. A. Redon. Mar. 11, 1958. 22p. $4.80(ph), $2.70(mf) OTS.

A discussion of a pilot-scale unit providing for U extraction, stripping, concentration, and solvent recovery is presented. The unit will be operated with natural U or other tracer level solutions to study the efficiency, capacity, resistance to corrosion, constancy, and reliability of measurements. Industrial-scale verification is scheduled to follow. The information will serve as a basis for detailed studies to be carried out by the group in charge of the installation. Information contained in TR-5, -9, and -13 is modified by this report. (J.R.D.)

16901 NP-7677

European Company for the Chemical Processing of Irradiated Fuels, Mol, Belgium.

BASIC CONSIDERATIONS ON INSTRUMENTATION. Technical Report No. 21. R. Winckler. Nov. 14, 1958. 15p. $3.30(ph), $2.40(mf) OTS.

Basic considerations of instrumentation for the Eurochemic fuel reprocessing plant are discussed. Instrument electrical supply and signal amplifications are examined along with the use of electrical regulators and the design of consoles which group several common indicators. A design description of the main control panel is also given with a listing of the instruments included in the group. Local indicating and service instruments are also described. Selection of in-line instruments is discussed with emphasis on uniformity. Finally, data sheets are discussed, and an explanation of the planned instrument record file is given. (J.R.D.)

16902 NP-7678

European Company for the Chemical Processing of Irradiated Fuels, Mol, Belgium.

DRILLING TEST. Technical Report No. 22. E. Luscher. Nov. 15, 1958. 5p. $1.80(ph), $1.80(mf) OTS.

A proposal is presented for a drilling test at the Eurochemic plant site to survey underground waters and subsoil. Information obtained in this project can be used in contamination hazard evaluations and in determining the availability of water for plant operations. Some information on the area is already available and will supplement that gained in the drilling test. A full description of the project is given. (J.R.D.)

16903 NP-7679

European Company for the Chemical Processing of Irradiated Fuels, Mol, Belgium.

MATERIAL BALANCE FLOW SHEET. Technical Report No. 23. [E.] Hoffmann, [E.] Detilleux, [A.] Redon, and [M.] Zifferero. Dec. 4, 1958. 33p. $7.80(ph), $3.30(mf) OTS.

Supplement to Technical Report No. 14.

Material balance flowsheets for the Eurochemic reprocessing plant are presented. General considerations concerning α and β activities in the effluents are examined in relation to Belgian limits. Also, material balance and pretreatment activity balance were calculated and are presented tabularly, including data on gaseous effluents during pretreatments. Data on material balance and activity in final treatments are tabulated in addition to procedure and data on material balance and activities in solvent purification. Flowsheets for treatment of very active effluents are also presented along with procedures for waste effluents. A general flowsheet showing recycling of the solutions from one section to another is included. (J.R.D.)

16904 NP-7682

European Company for the Chemical Processing of Irradiated Fuels, Mol, Belgium.

CONSIDERATIONS ON THE DETERMINATION OF THE DAILY EXTRACTION CAPACITY AND THE WORKING CAPACITY OF THE COLUMNS OF THE EUROCHEMIC PLANT. Technical Report No. 28. A. Redon, E. Detilleux, E. Hoffmann, and O. Jenne. Jan. 9, 1959. 6p. $1.80(ph), $1.80(mf) OTS.

The daily extraction capacity and the working capacity of the Eurochemic columns are examined. The various parameters are discussed, and it is concluded that the extraction can be performed in 200 days per year with a daily capacity of 500 kg of U. The maximum desirable capacity in a column is about 80% of the flooding capacity, and it appears desirable to design the extraction columns to function at 50% of this flooding capacity for natural U and 80% for slightly enriched material. (J.R.D.)

16905 NP-7683

European Company for the Chemical Processing of Irradiated Fuels, Mol, Belgium.

COST ESTIMATE FOR THE FIRST EUROCHEMIC RESEARCH LABORATORY PROJECT AND PROPOSAL FOR A REDUCED RESEARCH LABORATORY. Technical Report No. 29. W. Schüller. Jan. 20, 1959. 9p. $1.80(ph), $1.80(mf) OTS.

A tentative cost estimate is presented for the Eurochemic Research Laboratory, based on the preliminary design outlay (ETR 17) of the building. Construction costs were calculated on the basis of gross building volumes and specific prices per cubic meter as established by European laboratory construction practice. Exceptionally expensive facilities (i.e., hot cells) and some large pieces of laboratory instrumentation were calculated separately. The total construction cost of the first project is about 3 million dollars, completely installed. Therefore, an alternative project for a reduced laboratory has been prepared, which is estimated at 1.5 million dollars. A layout scheme for the second project and the cost estimate are included. (auth)

16906 NP-7684
European Company for the Chemical Processing of Irradiated Fuels, Mol, Belgium.
ENVIRONMENTAL RADIATION EXPOSURE FROM THE EUROCHEMIC REPROCESSING PLANT. Technical Report No. 30 (Revised). H. H. Ph. Moeken. Feb. 19, 1959. 21p. $4.80(ph), $2.70(mf) OTS.

The gaseous radioactive release of the Eurochemic Processing plant contains Xe^{133}, Kr^{85}, I^{131}, and small particles bearing beta and alpha emitters. The maximum permissible contamination of air, milk, and plants in the environment of the plant are proposed. After making some assumptions of the meteorological conditions during release, the environmental exposure in the worst possible direction is estimated. The I^{131} concentration in milk seems to be the critical point. Some improvements in order to decrease the contamination level are proposed. (auth)

16907 NP-7686
European Company for the Chemical Processing of Irradiated Fuels, Mol, Belgium.
EUROCHEMIC SPECIFICATIONS FOR PROCUREMENT, FABRICATION AND TESTING OF STAINLESS STEEL MATERIAL AND EQUIPMENT. Technical Report No. 32. O. Jenne. Feb. 4, 1959. 33p. $6.30 (ph), $3.00(mf) OTS.

Specifications covering minimum standards for the fabrication of welded pressure-containing equipment and intended to achieve long-time maintenance-free integrity in highly corrosive chemical processing service are given. Also included are specifications for stainless steel procurement, welder proficiency standards for metal arc, and inert arc welding. (J.R.D.)

16908 NP-7687
European Company for the Chemical Processing of Irradiated Fuels, Mol, Belgium.
FINAL PURIFICATION OF PLUTONIUM: PROCEDURE TO BE USED IN THE EUROCHEMIC PLANT. Technical Report No. 33. M. Zifferero, M. Lung, and A. Redon. Feb. 18, 1959. 16p. $3.30(ph), $2.40(mf) OTS.

Detailed development of the final Eurochemic process flowsheet is presented. Proposed apparatus arrangement is included, and reasons for modifications of the preliminary operational flowsheet are given. In addition, new aspects of the purification of Pu are considered for the first time, especially the general plan, the problems of protection against gamma and alpha radiation, and diagrams of the adsorption cycle. (J.R.D.)

16909 NP-7688
European Company for the Chemical Processing of Irradiated Fuels, Mol, Belgium.
COMPARATIVE STATUS OF COMMERCIAL PROPOSALS FOR CONSTRUCTION OF A LIQUID-LIQUID EXTRACTION PILOT PLANT. Technical Report No. 34. A. Redon. Feb. 24, 1959. 20p. $3.30(ph), $2.40(mf) OTS.

The various company bids on construction of Eurochemic liquid-liquid extraction pilot plant are compared. The chief screening criterion of the study is the technical detailing; also bids which propose several variants of problem solving show careful bidder considerations and are weighted accordingly. Three companies are named for the final competition, and the proposals of these are compared considering details of general arrangements, civil engineering, general services, general apparatus, and measuring and control apparatus. (J.R.D.)

16910 NP-7689
European Company for the Chemical Processing of Irradiated Fuels, Mol, Belgium.
LIQUID WASTE MANAGEMENT AT THE EUROCHEMIC REPROCESSING PLANT. Technical Report No. 35. H. H. Ph. Moeken and J. J. H. Alderhout. Mar. 26, 1959. 15p. $3.30(ph), $2.40(mf) OTS.

The volumes and activities of the several effluents from the Eurochemic reprocessing plant and research laboratory are estimated by extrapolation from Idaho Plant data. Two treatment plans are offered, based on the effluent estimates and published waste disposal methods. The schemes include waste evaporation and chemical treatment. Detailed examination and comparison of the methods are made and radioactive product discharge rates with different plant throughput rates are tabulated. (J.R.D.)

16911 NP-7690
European Company for the Chemical Processing of Irradiated Fuels, Mol, Belgium.
FUEL ELEMENT INVESTIGATION—COMPILATION OF DATA. Report ED-C. Apr. 3, 1959. 25p. $4.80(ph), $2.70(mf) OTS.

A compilation of estimation quantities of spent fuels from each subscribing country for inclusion in the Eurochemic processing load is presented. Also included are data on types of fuel, enrichment, and probable delivery period. From these data charts are developed which graphically present projected processing loads. (J.R.D.)

16912 NP-7691
European Company for the Chemical Processing of Irradiated Fuels, Mol, Belgium.
PROPOSAL FOR ANALYTICAL IN-LINE INSTRUMENTATION. Technical Report No. 37. K. Samsahl and R. Winckler. Apr. 6, 1959. 22p. $13.80(ph), $4.80 (mf) OTS.

Measurements that give information on the composition of solutions and gases in the Eurochemic plant processes must be continuous. A preliminary plan of projected sampling and measuring points is presented. The data used as a basis for the plan were taken from TR-14, TR-23, TR-25, and TR-26. Measuring methods were described, and use of the data is discussed. Flowsheets and tabular analytical charts are included. (J.R.D.)

16913
EXTRACTION OF URANIUM TETRACHLORIDE BY TRIBUTYL PHOSPHATE. Eiichi Iwase and Toshiaki Isono. Sci. Papers Inst. Phys. Chem. Research (Tokyo) 53, 13-16(1959) Mar.

The partition coefficient of uranium tetrachloride between 20 volume percent TBP–kerosene and aqueous phases has been determined at 25°C in the presence of either hydrochloric acid, sodium chloride, magnesium chloride, or aluminum chloride. For various amounts of hydrochloric acid, the partition equilibrium of uranium tetrachloride has been measured between organic and aqueous phases. From this measurement it may be concluded that a compound $UCl_4 \cdot 3TBP$ is formed in TBP–kerosene solution. (auth)

CONTROLLED THERMONUCLEAR PROCESSES

16914 CF-55-4-73
Oak Ridge National Lab., Tenn.
PROPOSED SHERWOOD EXPERIMENT. John S. Luce. Apr. 11, 1955. Decl. Oct. 20, 1958. 5p. Contract [W-7405-eng-26]. $1.80(ph), $1.80(mf) OTS.

It is proposed to take advantage of the molecular ion (D_2^+) output from ion sources. The ions are accelerated from the source into a vacuum volume containing a magnetic field. At some point in their trajectory, the ions are stripped of their remaining electron. The success of this concept depends on efficient stripping of molecular ions into atomic ions. One geometry which lends itself to the stripping schemes is 90° focusing. For this experiment a 180° mass spectrograph would be used. An arc containing energetic electrons would be injected along the focal plane of the beam. The changes produced by this arc in the number of molecular and atomic ions reaching the targets would be measured. (A.C.)

16915 CF-59-6-32
Oak Ridge National Lab., Tenn.
CONTAINMENT PROPERTIES OF DCX. T. K. Fowler and M. Rankin. June 15, 1959. 8p. Contract [W-7405-eng-26]. $1.80(ph), $1.80(mf) OTS.

The "absolute" containment of ions in the DCX magnetic mirror field resulting from the cylindrical symmetry of the field is discussed. The regions of confinement in space and momentum are plotted for 300-kev deuterons. (auth)

16916 NP-7702
[Space Technology Labs., Inc. Physical Research Lab., Los Angeles.]
ON THE CONFINEMENT OF A PLASMA BY MAGNETO STATIC FIELDS. Erich S. Weibel. [1958]. 18p. (GM-TR-0127-00019).

The plasma is treated as an assembly of classical particles having masses m_+ and m_- and charges $\pm e$. It is shown that if such a plasma is in thermodynamic equilibrium it is unaffected by a magneto-static field. In particular, it cannot be confined by a magneto-static field and at the same time be in equilibrium. In absence of collisions there exist stationary solutions for the magnetic field and the particle distribution in phase space such that the gas is confined. The solutions are self-consistent, meaning that the particle motions generate the field, which in turn maintains the particle distribution. However, this distribution may not be Maxwellian. The linear pinch is treated as an example, and the fields, the particle number densities, and the current density are calculated for one particular case. (auth)

16917 NP-tr-270
THERMONUCLEAR REACTIONS IN A SYSTEM WITH MAGNETIC MIRRORS AND THE QUESTION OF DIRECT TRANSFORMATION OF NUCLEAR ENERGY INTO ELECTRICAL ENERGY (PHYSICAL PRINCIPLES AND PRELIMINARY CALCULATIONS). G. I. Budker. Translated for European Organization for Nuclear Research from p.1-31, Vol. III, of "Fizika Plazmy," Academy of Sciences, U.S.S.R., 1958. 37p.

This paper was previously abstracted from the original language and appears in NSA, Vol. 13, as abstract No. 640.

16918
OSCILLATIONS IN PLASMA. II. Shoji Kojima, Kiyoe Kato, Shigeo Hagiwara, and Ri'ichi Matsuzaki (Tokyo Univ., of Education). J. Phys. Soc. Japan 14, 821-7(1959) June.

As previously reported, two or three plasma-electron oscillations of slightly different frequencies are simultaneously generated in a hot cathode discharge. The filled gas is mercury vapor at pressures of 1 micron. These oscillations can be observed by a Yagi antenna set apart from the discharge tube as well as by a probe in it. In the discharges the primary electrons form convergent and divergent beams. The oscillation of the highest frequency is generated by the convergent beam in the central part of the tube and this is that observed by many authors. The oscillation of the lowest frequency seems to be generated near the wall of tube by the divergent beam. Another oscillation having a middle frequency is often observed. This is generated at the periphery of the convergent beam. (auth)

CRITICALITY STUDIES

16919 HW-57853
General Electric Co. Hanford Atomic Products Operation, Richland, Wash.
BUCKLING MEASUREMENTS OF FUEL ELEMENTS IN RANDOM ARRAYS. R. C. Lloyd. Oct. 21, 1958. 8p. Contract W-31-109-Eng-52. $1.80(ph), $1.80(mf) OTS.

The buckling was measured for three different fuel element types in random arrays. The average value of the buckling was less than the buckling of uniform arrays in all three cases, but in view of the 95% confidence limit, it is not considered advisable to increase the safe critical limits of random arrays above those of uniform arrays. (D.E.B.)

16920 K-1019(5th Rev.)
Oak Ridge Gaseous Diffusion Plant, Tenn.
CRITICALITY DATA AND NUCLEAR SAFETY GUIDE APPLICABLE TO THE OAK RIDGE GASEOUS DIFFUSION PLANT. H. F. Henry, A. J. Mallett, C. E. Newlon, and W. A. Pryor. May 22, 1959. 53p. Contract W-7405-eng-26. $1.50(OTS).

The available minimum experimental and theoretical criticality information for U^{235} enrichments of 1% to ~90% are presented together with the fundamental nuclear safety control criteria currently in effect at ORGDP. The fundamental nuclear safety criteria remain essentially unchanged from the previous edition of the report with the exception of the extension of nuclearly safe variables under 5% U^{235} enrichment, the increase of the minimum U^{235} enrichment considered to be non-reactive from 0.71% to 0.90%, and a statement of a new mass-volume principle. Other additions include guides for computing a solid angle and applying nuclearly safe variables to uranium materials, other than metal, of intermediate densities. (auth)

GEOLOGY AND MINERALOGY

16921 RME-3157
Massachusetts Inst. of Tech., Cambridge.
ELECTRODE AND MEMBRANE POLARIZATION. Interim Report for 1958. Theodore R. Madden and Donald J. Marshall. Feb. 1959. 117p. Contract AT (05-1)-718. $2.75(OTS).

A kinetic model for the electrical behavior of elec-

trode-solution interfaces is set up using the usual equations of motion for ions in a viscous medium, and a linear dependence of the reaction rates on changes in the concentrations and voltages occurring at the electrode, and by incorporating the fixed layer model used to describe the properties of ideal polarized electrodes. Various equivalent circuits can be derived which depend on the sequence of reactions postulated as taking place at the electrode. The parameters of these equivalent circuits can be simply related to the concentrations and diffusivities of the reacting species, and the standard free energy change associated with the reaction barrier by applying the transition state reaction rate theory. Laboratory measurements were made on a variety of metal and semiconducting electrodes, and theoretical equivalent circuits were fit to the data. Good fits were achieved with most of these cases and with others obtained from the literature. A rather remarkable uniformity of results with different electrodes under varying conditions is found. The explanation of this result remains an open question. There is little evidence that the reactions actually taking place at the electrodes are the ones usually postulated. The ion equations of motion used in the electrode-electrolyte interface problem are also used in the study of polarization in membranes. The membrane model consists of zones of alternating transference properties in series. The ion flow in the separate zones are coupled through the continuity conditions at the interface between the zones. The frequency dependence of the impedance of this model is associated with the buildup of concentration gradients at these boundaries. When large differences in the transference properties of the zones exist, the polarization effects can be very important. The impedance can vary with frequency by a factor of two or more. There is no simple equivalent circuit that represents this impedance, but it has been evaluated numerically for several cases. Experimental studies on the electrical impedances of ion exchange resins and pure clay systems have been made, and they revealed large frequency effects, some greater than 50%. These effects are spread out over a greater range than those in the theoretical model, but this is to be expected because of the wide distribution of zone lengths existing in a natural system. When a limited comparison is made between the experiments and theory, reasonable results are obtained. The importance of having alternating zones of different transference properties is emphasized by measurements on mixtures of anion and cation exchange resins. (auth)

HEALTH AND SAFETY

16922 CEA-868

France. Commissariat à l'Énergie Atomique, Paris.
ESSAIS DE DECONTAMINATION DES SURFACES CONTAMINEES PAR DU PLUTONIUM. (Decontamination of Plutonium-contaminated Surfaces.) J. Bertrand, Ch. Clouet d'Orval, and J. Tachon. July 1958. 9p.

The neutron distribution in the core of the Proserpine is measured by activation detectors placed in polyvinyl or polyethylene bags. The bags must be decontaminated before the detectors are removed. The removal of the Pu solution by rinsing with HNO_3, versene, H_2SO_4, citrosyl, and $KMnO_4$ solutions and by fixation with plexiglass was investigated. It was determined that a jet of HNO_3 gives the best decontamination. It is then possible to cover the bag with a layer of plexiglass to fixate the residual radioactivity. The tests showed that polyvinyl bags are more readily decontaminated than the polyethylene bags. (J.S.R.)

16923 ENCR-30

Chemical Corps Engineering Command, Army Chemical Center, Md.
PROTECTION OF STRUCTURES FROM CHEMICAL, BIOLOGICAL AND RADIOLOGICAL (CBR) CONTAMINATION. George P. Smith, Charles E. Bradford, Louis J. Iocca, and Henry R. Dickey. June 1959. 135p.

Basic technical information is presented on items of equipment and techniques developed by the Chemical Corps which are used to obtain Chemical, Biological, and Radiological (CBR) protection in structures. Section I outlines the purpose and scope of the report and describes the various CBR consulting services available throughout the Chemical Corps. Section II contains general requirements for protection against various forms of contamination (CW, BW, and RW) and discusses different types of existing structures and corresponding degrees of protection to which they can be remodeled. Section III contains detailed design criteria for CBR protective shelters. Discussion and illustrations of all necessary facilities and equipment are embodied. The description includes various graphs, charts, and tables showing desired pressures, air volumes, and flow characteristics. Section IV discusses the operation and maintenance of equipment incorporated in shelter design. Detailed procedures concerning establishment of optimum operating conditions are outlined in sequence of steps. Various decontaminants and their uses are also included. Section V describes available equipment for CBR protection. Photographs and drawings are included. Also embodied are equipment tables showing specifications and costs. (auth)

16924 M-7114

Weather Bureau, Washington, D. C.
EVALUATION OF THE GROUND-LEVEL SAMPLING PROGRAM. L. Machta and R. J. List. [1958]. 25p. $4.80(ph), $2.70(mf) OTS.

A summary is presented on the present state of U. S. Weather Bureau knowledge concerning ground-level deposition. Ground sampling techniques are described including those for ocean sampling. Hazard assessments for Sr^{90} and Cs^{137} are discussed, and the quantities of Sr^{90} in the stratosphere, the troposphere, and deposited on the ground are estimated. Also the mechanisms of transport and removal of particulates containing Sr^{90} and/or Cs^{137} from the atmosphere are examined. (J.R.D.)

16925 NP-7680

European Company for the Chemical Processing of Irradiated Fuels, Mol, Belgium.
HEALTH PHYSICS PROGRAM. Technical Report No. 24. H. H. Ph. Moeken. Dec. 4, 1958. 6p. $1.80(ph), $1.80(mf) OTS.

The organization of the health physics program is reviewed. (C.H.)

16926 SC-4180(TR)

Sandia Corp., [Albuquerque, N. Mex.].
THE TRACKING OF FALLOUT BY MEANS OF A SLOWLY DESCENDING BALLOON. K. L. Shipley. Apr. 1958. 23p. Contract [AT(29-1)-789]. $4.80(ph), $2.70(mf) OTS.

The possibility of designing a balloon which, when placed in an atomic cloud, will duplicate the motion of certain fall-out particles is considered. While this is

theoretically possible, the motion of the balloon is very sensitive to solar heating which results in some restriction of this application. (auth)

16927 TID-5562

Atomic Energy Commission, Washington, D. C. and Department of Agriculture.

EFFECTS OF A NUCLEAR ATTACK ON SOILS AND CROPS. R. F. Reitemeier and R. G. Menzel. Aug. 1959. 10p. $0.14(OTS).

Presented at the Hearings on the Biological and Environmental Effects of Nuclear War, before the Special Subcommittee on Radiation, Joint Committee on Atomic Energy.

A nuclear attack would have serious effects on agricultural resources and food production in the United States. The damage to agriculture would include both immediate and delayed effects on soils and crops. The effects and behavior of fall-out on plants and soil are discussed. Emphasis is placed on the effects of cesium-137 and strontium-90 on contamination of food chains. Procedures are described for the decontamination of agricultural land areas. (C.H.)

16928 AEC-tr-3717

CONFERENCE ON THE PROBLEM OF RADIOACTIVE STRONTIUM. N. O. Razumovskii. Translated by Lydia Venters (Argonne National Lab.) from Med. Radiol 4, No. 3, 92-4(1959). 5p. $1.80(ph), $1.80(mf) JCL or LC.

The activities of a Moscow conference on radioactive strontium is reported. Data from studies of the Sr content in the atmosphere, soil, ground water, water reservoirs, and food are presented and discussed. Increase in Sr^{90} due to weapons testing is noted. Animal experimental results are emphasized, and various other biological aspects are discussed. (J.R.D.)

16929 CEA-tr-R-627

RECLEMENT SANITAIRE POUR LE TRANSPORT DES SUBSTANCES RADIOACTIVES. (Sanitary Regulation for the Transport of Radioactive Substances.) Translated from a Russian Publication, Moscow, 1957. 22p.

Rules and regulations for the receipt, loading, and transportation of radioactive materials are presented. The regulations consider permissible dose for personnel, classification of radiation sources, classification of transportation containers, required characteristics of containers and packing cases, marking of packing cases for transportation, transportation conditions, transportation of radioactive substances by different types of transport, transportation by automobile, railway, air, mail, and ship, arrangements in case of the deterioration of the packing case, return of the empty packing cases, arrangement for the delivery and receipt of the radioactive substances, and arrangements for the transportation. (J.S.R.)

16930

POLONIUM^{210}. Am. Ind. Hyg. Assoc. J. 20, 251-2(1959) June.

Recommended procedures are outlined for handling polonium-210. Data are included on properties and maximum permissible exposure levels. (C.H.)

16931

RADON AND ITS DAUGHTERS. Am. Ind. Hyg. Assoc. J. 20, 253-4(1959) June.

Recommended procedures are outlined for handling radon. Data are included on properties and maximum permissible exposure levels for radon and its daughters. (C.H.)

16932

PERSONNEL MONITORING FOR EXTERNAL RADIATION: A NATIONAL SERVICE. J. F. B. Dealler, B. E. Jones, and E. E. Smith (Ministry of Health and Medical Research Council, Sutton, Surrey, Eng.). Occupational Safety and Health 8, 137-53(1958) July-Sept.

The recommendations of the International Commission on Radiological Protection are reviewed. A brief discussion is included on monitoring methods. A film dosimeter is described which has been widely used as a personnel dosimeter. A comprehensive survey is included of the organization required for a personnel monitoring service on a national scale. The use is discussed of punched cards for the analysis of cumulative dose data and for statistical research into radiation effects on populations. (C.H.)

16933

SOVETSKIYE UCHENYYE OB OPASNOSTI ISPYTANIY YADERNOGO ORUZHIYA. (Soviet Scientists on the Danger of Nuclear Weapon Tests.) A. V. Lebedinskii, A. F. Alyab'yev, and Ye. M. Mazel', eds. Moscow, Atomizdat, 1959. 116p.

A collection of articles discussing the harmful effects of radiation on animals and plants is presented. The collection is for biologists and other scientists interested in the problem of fall-out. Data on fall-out studies in the USSR are included. Strontium, carbon, and cesium isotopes found in fall-out from nuclear weapon explosions are investigated. (J.S.R.)

16934

MAXIMUM PERMISSIBLE BODY BURDENS AND MAXIMUM PERMISSIBLE CONCENTRATIONS OF RADIONUCLIDES IN AIR AND IN WATER FOR OCCUPATIONAL EXPOSURE. National Bureau of Standards Handbook 69. Washington, D. C., National Bureau of Standards, 1959. 102p. $0.35(GPO).

Recommendations of a group of experts in the field of radiological protection are presented for the guidance of those working in the field of radiation. The recommendations of this handbook take into consideration the statements of the National Committee on Radiation Protection and Measurements published in Handbook 59 issued by the National Bureau of Standards in 1958. Included in this volume are basic standards of maximum permissible radiation exposure, maximum permissible values for occupational exposure to radiation, and tables of constants and conversion factors for use in calculating radiation exposure. (C.H.)

INSTRUMENTS

16935 CEA-870

France. Commissariat à l'Énergie Atomique, Paris.

CHAMBRE D'IONISATION À FISSION POUR LA MESURE DES FAIBLES FLUX DE NEUTRONS LENTS. (Fission Ionisation Chamber for the Measurement of Low Fluxes of Slow Neutrons.) J. Weill and J. P. Duchene. July 1958. 14p.

An ionization chamber designed for the measurement of slow neutron fluxes of average or low intensity in the presence of very high gamma fluxes is described. The neutrons are detected by uranium fission which gives rise to high energy fission fragments. The fission fragments ionize the gas in the chamber and the collection of the charges produced on the collecting electrode determines a potential pulse which is amplified and measured. The pulses are counted by a system con-

sisting of a preamplifier, a 2 Mc amplifier, a discriminator, and numerator or integrator electronic scaler. The general characteristics of the ionization chamber are determined and tabulated. (tr-auth)

16936 CF-58-10-13

Oak Ridge National Lab., Tenn.

THERMOCOUPLE LIQUID LEVEL INDICATOR USED ON COLD TRAP STANDS. R. D. Peak. Oct. 3, 1958. 6p. Contract [W-7405-eng-26]. $1.80(ph), $1.80(mf) OTS.

Thermocouple liquid level indicators for use in detecting and controlling NaK levels in surge tanks were built and tested. While the indicators were not tested against another type of level measuring device, they performed satisfactorily and demonstrated the feasibility of pressure differential manual control. (J.R.D.)

16937 CNI-9

Italy. Comitato Nazionale per le Ricerche Nucleari. Centro Nazionale per le Ricerche Nucleari, Ispra.

SERVOMOLTIPLICATORE DI PRECISIONE ±0,025%. (Servomultiplier with a Precision of ±0.025%.) Renzo Tasselli. Feb. 1959. 16p.

The design and characteristics of a servomultiplier with a precision of 0.025% for use in a reactor simulator are given. The characteristics of the components used are tabulated. Schematics of the a-c and d-c amplifiers are presented, and the response of each is diagrammed. Test results on the performance of the servomultiplier are given. (J.S.R.)

16938 CNI-15

Italy. Comitato Nazionale per le Ricerche Nucleari, Milan.

STANDARDISATION OF ALPHA AND BETA EMITTERS BY 4pi COUNTER. PART I. THE COUNTER. G. Bertolini and O. Terracini. June 1959. 14p.

A 4π proportional gas flow counter for standardization of α and β emitters is described. (auth)

16939 HW-59755

General Electric Co. Hanford Atomic Products Operation, Richland, Wash.

DESIGN CRITERIA OF A CONSUMABLE ELECTRODE WELDER FOR WATER MIXING FUEL ELEMENTS. G. R. Hanson. May 12, 1959. 20p. $6.30(ph), $3.00 (mf) OTS.

The design criteria are presented for a consumable electrode welder for water mixing fuel elements, capable of welding in excess of 300 fuel elements per day. The criteria are listed, and a discussion of the prototype lathe and its operational difficulities is presented. Criteria for the production welding lathe are also presented. Detailed drawings are included along with photographs. (J.R.D.)

16940 NYO-3862

Johns Hopkins Univ., Baltimore.

A FAST NEUTRON SPECTROMETER. G. E. Owen and P. R. Chagon. Oct. 1953. 28p. Contract AT(30-1)-1251. $6.30(ph), $3.00(mf) OTS.

A neutron spectrometer is described which utilizes as a secondary ten trans-stilbene cylinders placed upon the circumference of a circle of 35-cm radius. These scintillators have a high efficiency coupled with low background-to-noise ratio. By this arrangement neutrons can be studied in terms of the proton recoil distribution produced within the scintillator. The spectrometer will record the spectra of gamma rays or neutrons depending on the amount of delay interposed between the primary and secondary signal. An angular distribution experiment performed with the neutron spectrometer is described, using the 0.72-Mev gamma resulting from the bombardment of Be with deuterons. The description of a linear gate circuit for pulse-height analyzers is also included. (J.R.D.)

16941 RDB(C)-8043

Gt. Brit. Culcheth Labs., Culcheth, Lancs, England.

A RECORDING PHOTOSEDIMENTOMETER FOR PARTICLE SIZE ANALYSIS IN THE SUB-SIEVE RANGE. G. D. Bell and E. Proudfoot. Mar. 12, 1953. 21p.

A recording photosedimentometer for use in determination of particle size distribution and surface area is described. Results obtained with a number of metal powders are given, and comparisons are made with those obtained by other methods. (auth)

16942 SCTM-275-56(14)

Sandia Corp., Albuquerque, N. Mex.

A MODERN CONCEPT OF ELECTRONIC PACKAGING. R. P. Noble. Jan. 8, 1957. 33p. Contract [AT(29-1)-789]. $6.30(ph), $3.00(mf) OTS.

The relationship between human engineering, design approach, and engineering management is presented. Application of electronic packaging with printed circuit design is discussed, and several slides illustrating finished units are shown. A modern design approach is explained, both from management's standpoint and the design engineer's point of view. Design procedure is discussed and the various functions and responsibilities of a design group are outlined. (auth)

16943 UCRL-8767

California. Univ., Berkeley. Lawrence Radiation Lab.

BEAM-PROFILE INDICATOR FOR 184-INCH CYCLOTRON (thesis). Robert L. Brown. May 19, 1959. 17p. Contract W-7405-eng-48. $0.75(OTS).

Submitted to the United States Naval Postgraduate School. Monterey, Calif.

A closed-circuit television chain was constructed and evaluated as a monitor for the external charged-particle beam of the 184-inch cyclotron. A sheet of plastic scintillator placed in the beam gave off light which was picked up by the camera and transmitted to the remote counting area for direct display. Magnetic shielding of the camera's deflection and focusing components was necessary for operation in the cyclotron fringing field. A light-tight enclosure for the scintillator and camera lens permitted the image orthicon to be adjusted for a light sensitivity not attainable in high ambient light levels. A beam of 10^7 protons dispersed over an area of approximately 4 cm^2 was adequately monitored with this equipment. Beams of 10^5 particles over the same area should be discernible when the system is optimized. (auth)

16944 WADC-TR-58-596

Massachusetts Inst. of Tech., Cambridge. Dynamic Analysis and Control Lab.

SUMMARY REPORT ON FLUID POWER CONTROL TO THE UNITED STATES AIR FORCE. [Period covered]: March 16, 1957 to September 30, 1958. P. F. Mayfarth, F. D. Ezekiel, S. Y. Lee, and H. H. Richardson. Oct. 2, 1958. 36p. Contract AF33(616)-3173. (AD-30305).

Research and development activities in the field of fluid power control have continued along the lines of advancing basic knowledge of fluid power control elements and developing experimental systems and working models for possible applications to flight control of ad-

vanced weapons systems. Additional emphasis has been placed on high pressure pneumatic systems showing good promise of working at elevated temperatures on very hot gases. Much of the work carried out this past year has been concentrated on problems which must be solved for both hot and cold gas operation, and the experimental phases have been carried out with cold (room temperature) gases because of difficulties of making fully instrumented hot gas experiments. The basic information sought has been much more easily derived from cold gas tests than it would have been from hot gas tests. It appears that one of the major problems to be overcome in order to develop effective, fast-response hot gas systems is the problem of converting controlled hot gas energy to mechanical energy in a simple, reliable way without introducing excessive dynamic response time. (auth)

16945 CEA-tr-A-533

SPECTROMÈTRE À SCINTILLATIONS POUR RAYONNEMENT γ. (Scintillation Spectrometer for γ Radiation. [Part I].) K. Jordan. Translated into French from Arch. tech. Messen, Lfg. 260, 193-6(1957). 16p.

Gamma quanta striking a crystal are absorbed by several different processes to form electrons of various energies. The electrons are then absorbed and scintillations are emitted. The interaction of gamma radiation with matter is considered generally with a discussion of the photoelectric effect, the Compton effect, and pair formation and the comparative frequency of these three processes. The general discussion is then particularized, and the absorption of gamma radiation in NaI crystals is described. Photoelectric effect, Compton effect, and pair formation and the frequency of these processes in sodium iodide crystals are discussed. (J.S.R.)

16946 SCL-T-253

A MEASURING DEVICE FOR TESTING THE ELECTROMAGNETIC MATERIAL CONSTANTS (CHARACTERISTICS) OF SOLID AND LIQUID MEDIA AT FREQUENCIES RANGING FROM 30 Mc TO 7000 Mc, AND AT TEMPERATURES BETWEEN −60° AND +240°C. (Messplatz zur Bestimmung der elektromagnetischen Stoffkonstanten fester und flüssiger Medien bei Frequenzen zwischen 30 und 7000fMHz und Temperaturen zwischen −60° und +240°C.) R. Eichacker. Translated by Marcel I. Weinreich (Sandia Corp.) from Rohde and Schwarz Mitt., No. 11, 185-205(1958). 70p. $10.80(ph), $3.90(mf) JCL or LC. (Figures and tables partially illegible).

Coaxial standing-wave detectors and coaxial specimen containers are used to determine the material constants of isotropic media over continuous spectra. Details are given on the relations between the material constants epsilon, mu, tan $delta_{eps}$, tan $delta_{mu}$, on the one hand and the line parameters on the other hand, and methods for their determination are described. Formulas give a survey of the most favorable method of measurement or evaluation. Finally, the results of a few measurements on ferrites and insulants are stated. (auth)

16947

INVESTIGATIONS ON SPARK DISK COUNTERS. Erich Bagge and Lothar Schmieder. Atomkernenergie 4, 169-81(1959) May. (In German)

The gas discharge mechanism in the spark disk counter was examined in the acetone−argon mixture by measurements of the Townsend coefficients and the plateau at different mixing proportions and gas pressures. It appears that there is a maximum value of the overvoltage and gas amplification factor, which lie at a mixing proportion of about 10% and a pressure between 300 and 400 Torr. The maximum plateau is only reached with an increasing pressure of the gas vapor mixture, when the absolute vapor pressure reaches the values of 42 and 47 Torr, respectively, at an interelectrode distance of 0.55 and 0.26 mm, respectively. If one wishes to carry out orbit determinations of elementary particles with various counters, the accuracy of the measurements is limited both by the Coulomb scattering of the particle foils and by the inaccuracy of the gas discharge. The error as a result of Coulomb scattering is calculated according to the well-known scattering theories for a system of n counters. The average error determined by the gas discharge was measured at 0.2 mm. Apart from this the gas discharge produces 4% gross errors. Half the number of these error sparks is removed about 1 to 2 mm from the true transit place of the particle; the other half is scattered orderless over the surface. The gross errors most probably arise in the recovery period of the counter, when the voltage between electrodes has not yet reached its full value. With a lowering of the vapor pressure as well as with a reduction of the over voltage by 30%, no appreciable increase in errors appears. The same applies to those sparks which arise in the border zones of the counter. The retardation of the light-up pulse did not bring an increase in the number of errors either. (auth)

16948

A SIMPLE GAMMA RAY INSENSITIVE FAST-NEUTRON COUNTER. G. M. Griffiths, P. P. Singh, Y. I. Sau, and J. B. Warren (Univ. of British Columbia, Vancouver). Can. J. Phys. 37, 858-65(1959) July.

A gamma-ray insensitive fast-neutron counter is described which consists of a number of thin rectangular sheets of lucite coated with zinc sulfide and sandwiched together to form a rectangular block which is mounted on a photomultiplier. Pulse height spectra and absolute efficiency curves are presented for neutrons from 300 kev to 15 Mev. (auth)

16949

SPARK GAPS FOR FAST HIGH-VOLTAGE SWITCHING. H. Bruce McFarlane (Univ. of California, Livermore). Electronics 32, No. 31, 72-3(1959) July 31.

Spark gap switches which explode a wire by switching 30 kv in less than 10 mμsec are discussed and diagrams given. The jitter problem is solved by using one spark gap to trigger another. (C.J.G.)

16950

THE NUCLEAR GAUGE ... NEW LAB WORKHORSE. C. A. Stone (Illinois Inst. of Tech., Chicago). Ind. Labs. 10, No. 7, 42-5(1959) July.

Use of nuclear gages employing x rays produced from beta sources is discussed. The choice of beta emitter is discussed. (C.J.G.)

16951

CONTINUOUS DETECTION OF β-RADIATION IN AQUEOUS AND ORGANIC SOLVENTS. Paul Vercier and André Raggenbass (Commissariat a l'Energie Atomique, Saclay, France). Intern. J. Appl. Radiation and Isotopes 5, 213-17(1959) May.

A process is described for continuously detecting and recording the radioactivity of liquids emerging from chromatographic columns by means of a thin-window Geiger counter. A special arrangement by which the liquid layer is spread out gives greater counting effi-

ciency. This method, for which standard equipment can be used, is suitable for both aqueous and organic solvents (e.g., petrol ether, acetone, alcohol). Experiments in the separation of Pm^{147} and of compounds labelled with S^{35} and C^{14} show that it is equally suited to low and to very high activity levels, in the fields of both preparative and analytical chemistry. (auth)

16952

A FAST NEUTRON SPECTROMETER. Gyula Hrehuss, András Neszmélyi, and Károly Simonyi. Magyar Tudományos Akad. Központi Fiz. Kutató Intézetének Közleményei 6, 22-35(1958) Jan.-Apr. (In Hungarian)

A fast neutron time-of-flight spectrometer developed for measuring neutron spectra in the energy range 0.8 to 14 Mev is described. The fast neutron bursts are produced by deflecting the 200-kev deuteron beam of a Cockcroft-Walton accelerator. The neutron detector is a plastic scintillator, and the neutron signals are analyzed by a fast time analyzer of the single-channel type. The duration of the neutron bursts is 1 to 3 msec. The total time resolution is about 5 msec. (auth)

16953

SYNTHESIS AND MEASUREMENT OF PLASTIC PHOSPHORS. Gyula Binder and Albert Lajtai. Magyar Tudományos Akad. Központi Fiz. Kutató Intézetének Közleményei 6, 49-55(1958) Jan.-Apr. (In Hungarian)

A procedure was developed for the synthesis of two organic scintillating compounds from inland basic materials, and a procedure for polymerization was studied. Radiological measurements on the plastic phosphors thus produced are continuing. (auth)

16954

DECADE PULSE SCALER OF 10^{-6} RESOLVING POWER. Jozsef Bakos. Magyar Tudományos Akad. Központi Fiz. Kutató Intezétenek Közleményei 6, 98-102 (1958) Jan.-Apr. (In Hungarian)

The circuitry of a decade pulse scaler with 10^{-6} resolving power, which was built from domestic components, is presented. The control method to be used with the apparatus is described. (J.S.R.)

16955

THEORY OF TIME RESOLUTION IN SCINTILLATION COUNTERS. E. Gatti and V. Svelto (C.I.S.E. Labs., Milan). Nuclear Instr. & Methods 4, 189-201(1959) May.

Four methods of handling the output pulse current of a scintillation counter, for extracting time information, have been theoretically compared. Final graphs are given for the time resolution, which can be obtained with the four methods, as a function of parameters that describe the multiplier phototube and the scintillator. (auth)

16956

A NEW METHOD FOR TRACK ANGLE MEASUREMENT IN A GRIDDED IONIZATION CHAMBER. U. Facchini, E. Gatti, and F. Pellegrini (C.I.S.E. Labs., Milan). Nuclear Inst. & Methods 4, 221-7(1959) May.

A simple method of handling the information at the collector of a conventional gridded ionization chamber is described. This method, based on the evaluation of the maximum of the current at the collector, allows one to obtain a direct information on the angle formed by the tracks of the particles with the electric field. This maximum value is independent from the position of the track within the sensitive volume and from the energy of particles of identical mass. The method allows one to obtain the collimation of the particles, the range-energy study, and possibly, the development of neutron spectrometers based on the energy of gas recoil, and the (n,p) and (n,α) studies in which the angular distribution of the emitted particles is involved. (auth)

16957

FAST SCALING CIRCUITS. G. W. Huchinson, W. H. Wells, and D. H. White (Univ. of Birmingham, Eng.). Nuclear Inst. & Methods 4, 228-33(1959) May.

A scaler of 11 mμsec dead time has been designed and built for use at the Birmingham proton synchrotron. This unit is described, and the circuit elements that are used to define the dead time of scalers are discussed. (auth)

16958

MEASUREMENT OF THE POLARIZATION OF D-D NEUTRONS BY A SOLENOID. P. S. Dubbeldam, C. C. Jonker, and F. J. Heemskerk (Natuurkundig Laboratorium der Vrije Universiteit, Amsterdam). Nuclear Inst. & Methods 4, 234-8(1959) May.

A solenoid is described which turns the polarization vector of D−D neutrons over +90° or −90°, while the detectors remain in a fixed position. The method avoids the false asymmetries that may be introduced if one turns the detectors over 180° and it allows heavy shielding. This way a good accuracy was obtained. For a thick, golden "drive-in" target the relative left-right asymmetry was found to be $|R_0| = (4.6 \pm 0.2)\%$ at E_D = 450 kev and $\vartheta_{1\,lab} = 50°$; $\vartheta_{2\,lab} = 42°$. (auth)

16959

REGULARIZING ACTION OF SCALERS. J. Sandstad (Univ. of Oslo). Nuclear Instr. & Methods 4, 243-4(1959) May.

Pryor and Klein (Nuclear Instr. 4, 2(1959)) computed the regularizing action of a fast scaler preceding a slow one. Similar calculations made by the author are discussed, and results of numerical computations for different scale factors are given. (L.T.W.)

16960

AUTOMATIC SPECTROMETER FOR GAMMA RAYS. M. Frank (Istituto Superiore di Sanita, Rome). Nuovo cimento (10) 12, 385-8(1959) May 16. (In Italian)

A single-channel γ-ray spectrometer is described. The number of pulses counted on each channel is automatically recorded on a paper ribbon, and the apparatus is present for measuring the next channel. (auth)

16961

THIN-CRYSTAL SCINTILLATION COUNTER. K. E. Corrigan and H. S. Hayden (William Beaumont Hospital, Royal Oak, Mich.). Radiology 73, No. 1, 107(1959) July.

Design features are described of a thin-crystal scintillation counter which has proved highly advantageous for many types of diagnostic procedures such as the preoperative localization of malignant brain tumors after the administration of iodine-131 or phosphorus-32. (C.H.)

16962

VELOCITY MODULATION TYPE MASS SPECTROSCOPE. Hirohiko Ezoe and Tomonao Hayashi. Sci. Papers Inst. Phys. Chem. Research (Tokyo) 53, 1-8 (1959) Mar.

A non-magnetic velocity modulation type mass spectroscope is proposed which utilizes the bunching effect of velocity-modulated ion beams as in the case of the

Isotron devised by Wilson. While the isotron deals with a bunch of ions of an isotope formed at a definite position in space, the mass spectroscope is concerned with spatially distributed bunches, the problems being for the recording of mass spectrum consisting of these bunches. The necessary applied voltages, periods, and geometrical dimensions for practical uses are calculated. (auth)

16963

ELECTRON RESONANCES IN BIOPHYSICALLY IMPORTANT MATERIALS. I. PHYSICAL AND TECHNICAL BASES, A MICROWAVE SPECTROMETER FOR RADIOBIOLOGICAL INVESTIGATIONS. Albrecht Redhardt (Max-Planck-Institut für Biophysik, Frankfurt am Main). Strahlentherapie 109, 133-43(1959) May. (In German)

The formation of paramagnetic resonance appearances is described by means of classical quantum theoretical conceptions. As cause for the formation of spectra, crystal field speading and hyperfine spreading are stressed. As an example, the radiobiological measurements of Gordy, Ard, Shields, Ehrenberg, and Zimmer on irradiated amino acids and fiber proteins are reviewed. A description of a microwave spectrometer with transit resonator is included. (auth)

16964

SPECTRAL ANALYSIS OF ISOTOPIC COMPOSITION. A. N. Zaidel. Uspekhi Fiz. Nauk 68, 123-34(1959) May. (In Russian)

Instrumentation for spectral analysis of the isotopic content is described, and data on He, Li, Pb, and U isotopic compositions are reviewed. (R.V.J.)

16965

REVIEW OF MULTICHANNEL AMPLITUDE ANALYZER RECORDING PRINCIPLES. G. P. Mel'nikov. Uspekhi Fiz. Nauk 68, 179-84(1959) May. (In Russian)

An analysis of multichannel recording arrangements in various analyzers is made in order to classify the devices according to performance for specific purposes. (R.V.J.)

METALLURGY AND CERAMICS

16966 58-GL-51

General Electric Co. General Engineering Lab., Schenectady, N. Y.

INVESTIGATION OF SOLID FILM LUBRICANTS AND SLIDING CONTACTS AT TEMPERATURES ABOVE 1000°F. M. B. Peterson. Feb. 5, 1958. 111p. Contract AF33(038)-21102.

An experimental investigation of solid film lubrication and high-temperature sliding contacts was conducted in order to choose those materials which are most effective as high-temperature solid lubricants and to study the sliding characteristics of materials at high temperatures. (auth)

16967 58-RL-2137

General Electric Co. Research Lab., Schenectady, N. Y.

THE STABILITY OF METALS UNDER CYCLIC PLASTIC STRAIN. L. F. Coffin, Jr. Oct. 10, 1958. 34p.

Observations are reported on the effect of steady stresses on the deformation of ductile metals subjected to cyclic plastic strain. Some of these observations have been made on 2S aluminum, including the progressive indentation of test specimens by the normal pressure of dial gages used for diametral strain measurements, and the simultaneous midsection necking and end bulging of an initially uniform diameter cylindrical test specimen when subjected to longitudinal push-pull loading so as to produce fully reversed plastic strain. To obtain quantitative information on the effect, combined cyclic plastic strain and steady torsion were applied to specially designed specimens of 2S aluminum. For example, elastically computed shearing stresses as low as 63 psi produced a significant twisting of the bar after 3200 cycles of a cyclic longitudinal strain range of 0.0086 inch/inch. Cyclic tension tests were undertaken on a variety of materials. Here a longitudinally loaded test specimen is gradually extended while simultaneously being subjected to a fully reversed plastic strain, such that for each strain cycle an increment of mean plastic strain is imposed. The mean stress required for such deformations is determined and found to be very low in relation to the flow stress of the material. Further, it is found to vary with the ratio of the cyclic to mean strain. Of further interest is the fact that the superposition of a cyclic strain during a tension test in many cases increases the ductility of the material and lowers the flow stress significantly. In the case of annealed OFHC copper, the ductility increase is of the order of 75% while for cold-worked copper this increase approaches 100%. Simultaneously the flow stress is lowered by as much as 25%. (auth)

16968 AECU-4186

Illinois. Univ., Urbana.

DIFFUSION IN METALS. Progress Report and Publication List. David Lazarus. June 1, 1959. 18p. Contract AT(11-1)-67, Project No. 3. $3.30 (ph), $2.40(mf) OTS.

Work on the determination of Fe^{55} and Fe^{59} diffusion rates in Cu and Ag is continuing. Difficulty in specimen preparation after radiochemical isotope separation is a major problem. Coefficients are presented for diffusion of Ru in Ag at 793 to 945°C. Studies on the effects of pressure on the mobility of quenched vacancies in Au by measuring the relative rates of excess resistivity annealing at two or more temperatures are reported, and preliminary data are given. Measurements of the effects of pressure on stress relaxation in the oxygen–vanadium system were made, and data on relaxation time as a function of pressure in V are tabulated. Construction of equipment and preliminary measurements, at atmospheric pressure, are reported on the effect of pressure on ionic conductivity in pure and doped alkali halides. Preliminary measurements of anelastic relaxation in silver–zinc were obtained in an investigation of the effect of plastic deformation on diffusion. Iron oxidation studies are reported for single crystal whiskers; correlation of oxidation nuclei with dislocation structure is difficult and study is being directed toward oxidation while the crystal is under stress. Oxidation at grain boundaries was also studied as well as hydrogen reduction of the oxide. (For preceding period see AECU-3770.) (J.R.D.)

16969 AGARD-180

North Atlantic Treaty Organization, Paris. Advisory Group for Aeronautical Research and Development.

RESISTANCE A LA FATIGUE D'UN COLLAGE METAL–METAL A SIMPLE RECOUVREMENT. (Fatigue Resistance of Metal-Metal Glued Joint with Slight Overlap.) L. Locati. Apr. 1958. 28p.

The behavior of glued steel sheets under alternating

stress is considered, and the results of fatigue tests made on Redox glued joints having an overlap of 22 mm are given. The test pieces, which included untreated and aged joints, were subjected to alternating and undulating stresses in a cycle range from 0.25 (static stress) to one million. The values obtained are compared with those obtained previously. The occurrence of fatigue rupture in metal-metal glued joint and the effect of various aging treatments on the fatigue strength are discussed. The fatigue strength for glued joints are compared with the fatigue strength for riveted joints. (tr-auth)

16970 BMI-1315

Battelle Memorial Inst., Columbus, Ohio.

PROGRESS RELATING TO CIVILIAN APPLICATIONS DURING JANUARY 1959. Russell W. Dayton and Clyde R. Tipton, Jr. Feb. 1, 1959. Decl. June 12, 1959. 86p. Contract W-7405-eng-92. $2.25(OTS).

Thermal-conductivity measurements are in progress on an unirradiated, unclad, natural uranium specimen. Thermal-conductivity measurements were made on medium-density UO_2. The creep properties of annealed and of 15% cold-worked Zircaloy-2 are being studied. Research to develop a method of sink-float density measurements to identify factors affecting radiation-induced volume changes in graphite was continued. A program was initiated to evaluate possible loss-of-coolant incidents in the Plutonium Recycle Test Reactor (PRTR) by means of simulation on a digital computer. Research on the casting of hollow Al–35 wt. % U extrusion billets has been concerned with the utilization of bottom-pouring techniques in conjunction with a movable pouring spout feeding into a horizontal centrifugal mold. The development of a method for the analysis of Mg in cement is in progress. Infrared and gas-chromatography analyses of irradiated dodecane, decane, cetane, octane, and their urea complexes were continued. The manner in which U metal solidifies in cylindrical graphite molds is under study. Valence effects of oxide additions to UO_2 are being investigated. Progress in the study of potential fueled moderators has continued with the determination of hydrogen-absorption isotherms for the Zr–25 wt. % U alloy and high-temperature x-ray diffraction patterns of hydrides of that alloy. The effects of fast neutron flux on the mechanical properties of AISI Type 347 stainless steel are being determined and evaluated. Several Nb-base alloy systems are being considered for physical- and mechanical-property evaluation with respect to cladding applications in fast reactors. The fabrication of U–Nb alloys by various means is being studied. Thorium–uranium alloys are being studied for the purpose of developing improved corrosion resistance and irradiation stability of the alloys by means of alloying and control of processing variables. Cermet fuel materials consisting of from 60 to 90 vol. % UO_2, UN, or UC dispersed in a stainless steel or Nb matrix are being investigated. The gas-pressure bonding technique is being investigated as a process for cladding fuel elements and assemblies with Mo and Nb. The irradiation behavior of UC– and UN–stainless steel dispersion-type fuel elements is being investigated. An experimental study of hydrogen migration in zirconium hydride under the influence of a thermal gradient is reported. The testing phases of the postirradiation examination of three pairs of fueled graphite spheres irradiated in capsule SP-1 were completed and results are reported. Titanium steam tubes are being exposed to initial and beginning Darex solutions. Data are presented on corrosion of INOR-1 and INOR-8 at various temperatures in a $NaF–LiF–ZrF_4$ salt. The postirradiation examination of twelve specimens of Th–11 wt. % U alloy was completed. Data are presented on the room-temperature tensile properties of arc-melted unalloyed Ta and nominal Ta–1.5 to 6.0 wt. % W alloys after vacuum annealing. The pressure bonding of Zircaloy-2-clad fuel elements containing compartmented oxide fuel plates is being investigated. (For preceding period see BMI-1307.) (W.L.H.)

16971 CEA-785

France. Commissariat à l'Énergie Atomique, Paris.

SOUDAGE DES METAUX SOUS VIDE. (Vacuum Welding of Metals.) J. A. Stohr and J. Briola. Dec. 1958. 8p.

The vacuum welding technique, which consists in the melting of metal pieces by the beam from an electron gun in a vacuum of 10^{-4} to 10^{-6} mm of mercury, is discussed. The welding apparatus has a metal enclosure in which the vacuum is produced, a cathode for electron emission, a high voltage generator for electron acceleration, a focusing device, and a mechanical device for moving or rotating the pieces to be welded. The advantages of this method are the possible welding of easily oxidized metals, fabrication of vacuum sealed containers, and production of penetrating welds. The possible applications of the technique are reviewed. (J.S.R.)

16972 CEA-800

France. Commissariat à l'Énergie Atomique, Paris.

ÉTUDE COMPARÉE DES TRANSFORMATIONS ALLOTROPIQUES DE L'URANIUM ET DU FER ET DE DEURS CONSÉQUENCES STRUCTURALES. (Comparative Study of the Allotropic Transformations in Iron and Uranium, and their Structural Consequences.) Pierre Lehr. 1958. 73p.

Thesis submitted to Univ. of Paris.

The $\alpha \rightleftharpoons \beta$ phase change in pure uranium and the $\alpha \rightleftharpoons \gamma$ phase change in pure iron follow a nucleation and growth process. The development of α nuclei during these transformations was studied by controlling, in a furnace with a temperature gradient, the slow and regular displacement of the interface between the two phases. In these conditions the number of α nuclei formed can be limited, and large crystals elongated in the direction of the temperature gradient or eventually single crystals are obtained. The crystallographic orientation and the degree of perfection of the uranium and iron crystals were analyzed. The dilatometric behavior of uranium monocrystals was studied as a function of their crystallographic orientations. The expansion coefficients along the three principal axes of the orthorhombic α cell were measured. By passing through the $\alpha \rightleftharpoons \beta$ or $\alpha \rightleftharpoons \gamma$ transformation points, it is possible to suppress all prior textures of the grain. Water-quenching of uranium from the β phase gives a grain without preferred orientation and with a size small enough so that statistical compensation of the expansion anisotropy of each grain can be obtained. The stresses created by the rapid passage of the transformation point cause a recrystallization of the metal during further annealing of the α phase. The volume change, accompanying the $\alpha \rightleftharpoons \beta$ transformation of uranium and the $\alpha \rightleftharpoons \gamma$ transformation of iron, produces, during the formation of the new phase nuclei and their subsequent growth, stresses large enough to produce a true deformation of the metal. The deformation characteristics, their structural consequences, and the effects

of thermal cycling in the transformation range were analyzed both for uranium and iron. (tr-auth)

16973 CEA-880

France. Commissariat à l'Énergie Atomique, Paris.
ÉTUDE DE LA DIFFUSION URANIUM–MOLYBDÈNE DANS LA SOLUTION SOLIDE γ CUBIQUE CENTRÉE. (Investigation of the Uranium–Molybdenum Diffusion in Body Centered γ Solid Solutions.) Y. Adda, J. Philibert, C. Mairy, and P. Bouchet. Mar. 1958. 21p.

The uranium–molybdenum intermetallic diffusion in the body-centered γ phase was studied by micrography, electron microanalyzer, and microhardness. The values of some penetration coefficients are given, and their physical significance is discussed. The diffusion coefficients, the frequency factors, and the activation energies were determined for each concentration. After a determination of Kirkendall effect in this system, the intrinsic diffusion coefficients for the uranium and molybdenum were calculated. (tr-auth)

16974 CF-58-1-118

Oak Ridge National Lab., Tenn.
PRELIMINARY ZIRCONIUM ALLOY DATA FROM LOOP L-2-17. J. E. Baker. Jan. 30, 1958. 9p. Contract [W-7405-eng-26]. $1.80(ph), $1.80(mf) OTS.

Core specimens of Zr alloys such as Nb–Zr and Fe–Nb–Zr were in-pile corrosion tested. Operating conditions are summarized for these and former similar tests. The corrosion solution contained UO_2SO_4, $CuSO_4$, and H_2SO_4, with a make-up solution composed of UO_2SO_4, $CuSO_4$, H_2SO_4, and Cr. Corrosion rates are tabulated and presented graphically. (J.R.D.)

16975 CF-58-2-77

Oak Ridge National Lab., Tenn.
RÉSUMÉ OF INFORMATION ON HYDROGEN IN TITANIUM ALLOYS AND ITS IMPLICATIONS TO HRP. J. P. Hammond. Feb. 12, 1958. 23p. Contract W-7405-eng-26. $4.80(ph), $2.70(mf) OTS.

A summary is presented of available information on the nature of H embrittlement in Ti, its control, and effects on other Ti properties. Most data also apply to Zr. Types of embrittlement are discussed, along with H sources and effects on mechanical properties. Also, the effects of H on forming heat treatment, and joining are discussed as well as Ti production and processing and methods of H removal. Finally, H in-service pick-up is considered, and methods for establishing the extent of this reaction are discussed. (J.R.D.)

16976 CF-58-4-48

Oak Ridge National Lab., Tenn.
HRP DYNAMIC CORROSION STUDIES (IN-PILE DEVELOPMENT). SUMMARY OF RUNS HT-20, HT-21, AND HT-22 (THORIUM OXIDE SLURRY). D. W. Hubbard. Apr. 15, 1958. 13p. Contract [W-7405-eng-26]. $3.30(ph), $2.40(mf) OTS.

Homogeneous reactor program runs HT-20, HT-21, and HT-22 are described. These runs were made to determine the handling characteristics of a slurry containing thoria calcined at 1600°C and to evaluate the operation of the 5-gpm slurry pump. The experimental procedures are described. It was concluded that 1600°C calcined 0.7 μ mean particle size thoria can be satisfactorily circulated using the 5-gpm pump. (J.R.D.)

16977 DMIC-Memo-22

Battelle Memorial Inst. Defense Metals Information Center, Columbus, Ohio.
ROUTING OF TITANIUM SHEET. C. T. Olofson. June 12, 1959. 6p.

Routing is a method of cutting sheet metal to produce various shaped blanks. The sheet material, either as single sheets or in stacks, is placed on a movable router table. A "router block" of appropriate pattern is then placed on top of the sheet material, and both are secured to the table top. The cutting operation is accomplished by guiding an overhead double-fluted rotating cutter similar to an end mill around the outline of this router block. (auth)

16978 HW-60276

General Electric Co. Hanford Atomic Products Operation, Richland, Wash.
SINTERING STUDIES ON THE SYSTEM UO_2–PuO_2. PART I. SOLID SOLUTION FORMATION. T. D. Chikalla. Apr. 27, 1959. 12p. Contract W-31-109-Eng-52. $0.50(OTS).

Solid solutions have been formed throughout the entire composition range in the system UO_2–PuO_2 by sintering at 1600°C in hydrogen. The single phase lattice parameters were found to vary linearly with composition, and it is evident that sintering in hydrogen does not cause reduction of plutonium dioxide to a lower oxide. Chemical dissolution tests indicate that solid solutions formed both by sintering and chemical coprecipitation enter acidic solution at nearly the same rate, and at a rate which is considerably higher than a physical mixture of the two phases. (auth)

16979 IGR-140(RD/CA)

United Kingdom Atomic Energy Authority. Industrial Group. Capenhurst Works, Capenhurst, Ches., England.
BRAZING GRAPHITE TO NILO-K TUBES. B. Stapleton. Apr. 28, 1959. 9p. $0.35(BIS).

A method of brazing graphite to Nilo-K tube is described. The object was to provide leak-tight joints between graphite samples and metal carrier tubes, for permeability measurements of the graphite at temperatures up to 900°C and high pressures. The specimen and tube are assembled, together with the brazing wire of copper–silver eutectic with a 12% titanium core, in a silica envelope, and brazing is done at 950°C in a high vacuum. Successful brazes have been made between Nilo-K tube and EY9, impregnated EY9, and reactor-grade "A" graphites. (auth)

16980 IGR-TM/S-027

United Kingdom Atomic Energy Authority. Industrial Group. Springfields Works, Springfields, Lancs, England.
THE ARC MELTING OF REFRACTORY METALS. SECOND REVIEW OF PROGRESS. J. A. Edwards and I. C. Hendry. [1955]. 21p.

Consumable electrode arc melting set control system modification is reported, and the technique for its use in arc melting molybdenum, vanadium, and uranium/molybdenum alloys is described. Good billets of molybdenum and uranium/molybdenum alloy were produced but the billets of vanadium were not satisfactory. All first-melt billets were produced in the 2½ in. ID mold and some of these were remelted into the 4 in. ID mold. (auth)

16981 KAPL-M-AME-16

Knolls Atomic Power Lab., Schenectady, N. Y.
DEVELOPMENT OF THE SiC RADIUM BERYLLIUM TEST SOURCE WELDS. Edward Bulson, Albert Ciancetta, and Thomas Smith. May 19, 1959. 12p. Contract W-31-109-Eng-52. $3.30(ph), $2.40(mf) OTS.

Two prime SiC radium–beryllium test sources

each containing 0.4 curie of radium were successfully fabricated by welding techniques without hot lab facilities. Health physics procedures were observed to assure that no person received radiation exposure exceeding that permitted by the AEC for the time period involved. All welds were made in a lathe with inert arc welding equipment. Development disclosed that control of the fit between parts and control of the welding atmosphere were vital to provide welds meeting specifications. Welding heat should be kept to a minimum as excessive heat increases the number and size of the voids especially on closure welds. (auth)

16982 KAPL-M-SAB-1

Knolls Atomic Power Lab., Schenectady, N. Y.

FATIGUE TESTS OF S3G UNIT CELL TUBE STRUCTURE SECTIONS. S. Beitscher and G. L. Cutler. June 12, 1959. 17p. Contract W-31-109-Eng-52. $3.30(ph), $2.40(mf) OTS.

Angle sections containing weldments were removed from S3G Zircaloy-2 tube structures and subjected to cycling unidirectional concentrated-loading bending stresses. The sections were tested so that the bending-induced stresses were a maximum at the fusion welded corners. Although the test results exhibited some scatter, the tests do indicate that the sections have a fatigue life of over 30,000 cycles at 34,000 psi maximum nominal bending stress range. From determinations of the notch radii of the corners of the sections and the test results, fatigue notch factors were determined. The results indicate that the maximum fatigue notch factor is below 2, and that the factor increases as the stress concentration factor increases, and then decreases. (auth)

16983 LMSD-48330

Lockheed Aircraft Corp. Missile Systems Div., Sunnyvale, Calif.

ELECTRON BOMBARDMENT MELTING AND CASTING OF BERYLLIUM. H. T. Sumsion and C. O. Matthews. Nov. 7, 1958. 43p. Contract NOrd 17017.

Electron-bombardment furnace and process for melting and casting 3-in. diameter beryllium ingots are described. The ultimate objective is to produce a beryllium or beryllium-alloy ingot which can be fabricated into plate. Initial metallurgical evaluations of the cast ingots were made by visual inspection, metallographic examination, chemical and x-ray diffraction analyses, machinability, hardness, and tensile and bend tests. Effect of variations in melt stock and process variables, including composition, on ingot structure have been investigated. Data are given for ingots evaluated to date. (auth)

16984 MAB-145-M

National Research Council. Materials Advisory Board.

FORMABILITY SCREENING PROCEDURES AS RECOMMENDED BY THE FORMABILITY WORKING GROUP OF THE MAB SUBPANEL ON EVALUATION OF THE DEPARTMENT OF DEFENSE TITANIUM ALLOY SHEET ROLLING PROGRAM. May 29, 1959. 19p. Contract DA-36-039-sc-76436.

The recommendations for uniform evaluation techniques to be used in phase III of the DOD Ti alloy program are presented. Detailed procedures for each type of test are given under the general headings of evaluation of structural member formability and evaluation of skin forming. (J.R.D.)

16985 NASA-M-5-13-59L

National Aeronautics and Space Administration. Langley Research Center, Langley Field, Va.

MEASUREMENTS OF TOTAL HEMISPHERICAL EMISSIVITY OF SEVERAL STABLY OXIDIZED NICKEL–TITANIUM CARBIDE CEMENTED HARD METALS FROM 600° TO 1,600°F. William R. Wade and F. W. Casey, Jr. June 1959. 31p.

The measurements are presented for both as-received and polished test specimens together with a brief description of the equipment and procedures used. Results of investigations of the surface condition of these materials as obtained by x-ray diffraction methods and metallurgical techniques are presented to indicate the type of surface on which these measurements were made. (auth)

16986 NAVORD-6056

Naval Ordnance Lab., White Oak, Md.

POLARIS MATERIALS PROGRAM. I. LITERATURE SURVEY. II. THERMAL AND MECHANICAL PROPERTIES OF CERAMICS, CERMETS AND METALS. F. J. Koubek, H. A. Perry, Jr., and I. Silver. Feb. 25, 1958. 87p.

Abstracts of literature and trip reports and data sheets on the thermal and mechanical properties of ceramics and metals in conjunction with the POLARIS Materials Program are given. (auth)

16987 NEPA-689

Ohio State Univ. Research Foundation, Columbus.

COATINGS FOR THE PROTECTION OF CERAMIC BODIES. Monthly Summary Report No. 13. F. H. McRitchie and N. N. Ault. July 28, 1948. 29p. Project 321. For Fairchild Engine and Airplane Corp. NEPA Div. Contract [W-33-08-ac-14801(16250)], Subcontract SC-2007. (AD-146568).

Reactions between coating materials were studied by pressing powdered materials into pellets and firing them in contact with beryllia disks. Coatings were prepared by wet spraying milled mixtures of the coating materials on beryllia. Firing was done in a porcelain muffle tube with controlled atmospheres of hydrogen or helium. A chromium–alumina coating was developed. A prolonged test at 2500°F (1370°C) revealed excessive weight loss. Silica was found to react violently with beryllia to give a bloated structure. Titanium–zirconia coatings had excellent structure, but penetrated into the beryllia. Wetting of beryllia by titanium was produced by firing a titanium pellet on a beryllia disk in a helium atmosphere. The titanium reduced the beryllia at the contact surface, and a third phase formed near the interface in the titanium. This reaction led to the development of a chromium–alumina coating with small titanium additions, which gave the most promising results. (auth)

16988 NMI-9408

Nuclear Metals, Inc., Concord, Mass.

BERYLLIUM RESEARCH AND DEVELOPMENT IN THE AREA OF COMPOSITE MATERIALS. Quarterly Progress Report to WADC for the Period January 1, 1959 to April 1, 1959. J. Greenspan, G. A. Henrickson, and A. R. Kaufmann. June 23, 1959. 69p. Contract AF33 (616)-5912.

Hot-pressed and rolled wrought Be was tested for bend ductility with sample width variable. Strip composite samples were fabricated where Ag was either the filler strip or the bonding agent to a Ti filler strip. Clad composites of 304 stainless steel, "A" nickel, Inconel, and titanium were fabricated by extrusion cladding and roll cladding. Tensile tests and bend tests were performed on Ag coated samples, for the purpose of noting any significant effects the coating might have

on ultimate mechanical properties. (For preceding period See NMI-9404.) (W.L.H.)

16989 NP-7706

Alloyd Research Corp., Watertown, Mass.

RESEARCH ON THE PROBLEM OF DUCTILITY IN BERYLLIUM. Progress Report No. 2. Joseph S. Lukesh. Jan. 1958. 16p. Contract AF33(616)-5300.

The rate of corrosion of silver by dry chlorine at 600°C and one atmosphere pressure was determined to be about one-thousandth of an inch in one hundred hours, a figure sufficiently low to make the use of silver apparatus in the halide reduction process entirely feasible. Several models of silver chloride values were constructed and tested. Difficulties in operation rendered this type valve impractical, and it was decided to control the flow of reactant vapors by adjusting helium pressure. An experiment was designed and equipment assembled to study the chlorination reaction of beryllium with respect to required flow rates of gases and the nature of the condensate. An induction furnace was designed and constructed for the zone-refining of commercial grade beryllium, and construction of the electron-beam equipment for ultra-high vacuum zone-refining initiated. (auth)

16990 NP-7707

Alloyd Research Corp., Watertown, Mass.

RESEARCH ON THE PROBLEM OF DUCTILITY IN BERYLLIUM. Progress Report No. 3. Joseph S. Lukesh. Apr. 1958. 15p. Contract AF33(616)-5300.

Experimental work on high-purity beryllium during the third quarter included a study of the preparation of beryllium chloride and construction of the various parts of the complete halide reduction system, preliminary induction zone-melting of seven-sixteenth inch rods, low vacuum evaporation of induction melted metal, assembly of the rough vacuum (10^{-6} mm Hg) system for the ultra-vacuum chamber, and design and initiation of construction of the ultra-vacuum chamber itself. The chlorination of beryllium was successful as were the preliminary zone-melting and evaporation experiments. (auth)

16991 NP-7713

Battelle Memorial Inst., Columbus, Ohio.

PROGRESS REPORT ON RESEARCH AND DEVELOPMENT OF PROCEDURES FOR ULTRASONIC WELDING SIMILAR AND DISSIMILAR HEAT-RESISTING ALLOYS. W. J. Lewis, J. N. Antonevich, R. E. Monroe, and P. J. Rieppel. June 15, 1959. 11p. Contract AF33(616)-6268.

An experimental plan has been drawn up to study the fundamentals of the ultrasonic-welding process and to determine the suitability of the process for joining material combinations that cannot be welded by conventional techniques. The ultrasonic-welding unit has been modified and reassembled. A new anvil has been designed and made and three new welding tips have been made. Work was started on measuring ultrasonic forces by attaching strain gages to the section between the welding tip and transducer. Studies were started on the effect of material variables on ultrasonic welding. The variables being investigated are: the effect of cold work, grain size, and yield strength on ultrasonic welding. The results of this part of the program are not yet available. (auth)

16992 NP-7718

Illinois Inst. of Tech., Chicago. Armour Research Foundation.

DEVELOPMENT OF A METHOD TO DETERMINE PLASTIC STRAINS AND STRESSES USING BRITTLE COATINGS. Final Report [for] November 1956 to May 31, 1959. Kenneth E. Hofer, Jr. and A. J. Durelli. June 1959. 144p. ARF Project No. K108. Contract DA-11-022-ORD-2346.

The brittle coatings method is used to determine the directions of the principal stresses in a plastically yielded specimen for which no theoretical solution is available. This is accomplished at several levels of plastic loading, giving the principal stress directions as the plastic enclave increases. A device for measuring the strain sensitivities of low sensitivity brittle coatings was constructed. This device was used to determine the strain sensitivity of several grades of "Stresscoat" (a commercial product) for various temperatures. Heterogeneous yielding as characterized on the macroscopic scale by Lueders' lines is also studied by means of brittle coatings. Various resinous and ceramic coatings are used to detect these Lueders' lines and their qualities are compared with each other. (auth)

16993 NYO-2294

Massachusetts Inst. of Tech., Cambridge. Dept. of Metallurgy.

THE ADAPTATION OF NEW RESEARCH TECHNIQUES TO MINERAL ENGINEERING PROBLEMS. Bi-Annual Progress Report for the Six-Month Period Ending April 30, 1959. 55p. Contract AT(30-1)-956. (MITS-42). $1.50(OTS).

Research on the solubility of quartz in water and alkaline solutions was concluded. A vertical electrophoresis cell especially designed for measuring the electrophoretic mobilities of flocculated particles was tested with AgI in Ag^+ and I^- containing solutions. The cell did not give reliable results because the streaming properties were complicated by the electrodes which made calculations of stationary levels impossible. A study of the adsorption of amine on AgI was initiated. The electrochemical technique was adapted. The adsorption of hydroxyl and hydrogen ions from aqueous solutions onto insoluble oxides is being studied. In an attempt to understand the flotation behavior of MnO_2 with cationic collectors, the adsorption of dodecylammonium chloride on the solid is being studied as a function of pH, ionic strength, and concentration of amine salt. Electrochemical investigations of the ethyl xanthate ion were continued. An investigation to obtain correlations between dependent and independent variables in the flotation process that will aid in the understanding of the mechanism by which flotation occurs is reported. An investigation to determine accurately the zero point of charge for hematite (Fe_2O_3) by streaming potential studies is presented. A study of the hysteresis of contact angles for the three-phase system of water, organic liquid, and solid was initiated. An investigation was carried out to determine whether picolinic acid or EDTA (ethylenediaminetetraacetic acid) was the better chelating agent for calcium ions. (For preceding period see NYO-2293.) (W.L.H.)

16994 NYO-8087

Carnegie Inst. of Tech., Pittsburgh. Metals Research Lab.

FUNDAMENTAL STUDY OF THE EARLY STAGES OF SINTERING. Final Report. June 30, 1959. 131p. Contract AT(30-1)-1826. $21.30(ph), $6.90(mf) OTS.

The process of sintering was examined in the early stages with emphasis on changes occurring at the very outset. Uncompacted, coarse powder was used. Methods

used in the investigation include microscopic examination of fractured samples, quantitative metallography, and closed surface topology. A discussion of the bases of the topological principles is given including a relationship for evaluation of a powder mass genus, a description of sintering stages, graphical representations of topological surface, modes of shape change during sintering, and mechanisms of metal transport. Specifications of the powders used are listed along with data on density and sintering densification rate in relation to genus. Also, data from experiments in which relatively large masses of powder were sintered, sectioned, and surveyed internally with respect to density are presented. Sources of error are examined, and methods of removal of side influences which have no bearing on sintering are discussed. The true rate of densification, evidenced by the moving together of particle centers, is of greatest technical interest, and problems associated with its determination are examined. Aspects considered include studies of impure densification, early growth, and the effects of gas expulsion in initial sintering stages due to surface and internal oxides. The microstructures of powders during sintering are examined, and photomicrographs are included. Data indicate that a kind of plastic deformation promotes grain growth. (J.R.D.)

16995 R58AGT591

General Electric Co. Flight Propulsion Lab. Dept., Cincinnati.

GRAPHITE AND ITS PROPERTIES. J. J. Cacciotti. July 1958. 89p.

A literature survey on graphite and its properties was conducted. Sections on fabrication, physical (mechanical) properties, and chemical properties are presented as well as an extensive bibliography and a list of suppliers with a brief description of their products. The many grades of graphite which are available and the wide range of properties reported in the technical and commercial literature can lead to confusion or misunderstanding. The survey report furnishes sufficient reference sources to permit the materials or design engineer to obtain reliable data upon which to base his decisions. (auth)

16996 RDB(C)/TN-45

Gt. Brit. Culcheth Labs., Culcheth, Lancs, England.

DETERMINATION OF THE COEFFICIENT OF LINEAR THERMAL EXPANSION OF METALS AT T°C. A REVIEW OF PROGRESS FROM DECEMBER 1, 1952 TO JUNE 1, 1953. S. M. Makin, J. Standring, and P. M. Hunter. July 8, 1953. 11p.

Determinations of the coefficients of thermal expansion of tantalum, titanium, zirconium, 18/8 and 18/13 stainless steel, and Nimonic 80 and 90 have been made, using a dial gage dilatometer, within the temperature range 20 to 900°C. An interferometric dilatometer has been designed and is under construction. (auth)

16997 RDB(C)/TN-47

Gt. Brit. Culcheth Labs., Culcheth, Lancs, England.

THE INFLUENCE OF WELDING ON THE CORROSION RESISTANCE OF 18/13/1 STEEL. EFFECT OF PRESSURE WELDING. H. N. Jones. July 1, 1953. 16p.

When 18/13/1 steel pipes are joined by pressure welding, subsequent exposure to boiling 70% nitric acid causes severe local attack. The regions sensitive to corrosion are on the outer surface of the pipe and take the form of narrow bands immediately adjacent to the weld junction. The inner surface of the pipe corrodes uniformly and at a normal rate. Investigation has shown that the local sensitivity to attack is probably a result of the thermal cycle through which these regions pass during the welding operation. It is not caused by the chemical nature of the heating gases, although an alteration in the character of the flame causes a corresponding alteration in the geometry of the sensitive region. A similar type of attack takes place on flash-welded pipes. (auth)

16998 RDB(C)/TN-74

Gt. Brit. Culcheth Labs., Culcheth, Lancs, England.

THE PRECISION CASTING OF URANIUM. A REVIEW OF PROGRESS TO FEBRUARY 12, 1954. H. N. Jones. 19p.

A survey was made of the possibilities of precision casting enriched uranium shapes for the fast reactor. Theoretically, the refractories most able to withstand molten uranium are stabilized zirconia, beryllia, and thoria. Simple melting experiments show, however, that with zircon, fused magnesia, and fused alumina, the rate of attack is very small, and may be negligible. A furnace was constructed, in which precision casting of uranium can be carried out. It is pointed out that precision casting does not eliminate machining operations, and that a large proportion of circulating scrap will be inevitable. The fuel element shapes now proposed are unsuitable for the precision casting technique, and it is therefore recommended that the present work be terminated. (auth)

16999 RDB(C)/TN-140

United Kingdom Atomic Energy Authority. Industrial Group. Culcheth Labs., Culcheth, Lancs, England.

THE CASTING OF IMPROVED URANIUM AND URANIUM ALLOY BARS FOR USE AS FUEL ELEMENTS. A REVIEW OF PROGRESS FROM DECEMBER 31, 1954 TO JUNE 27, 1955. H. N. Jones. Aug. 19, 1955. 12p. (IC/P-3).

The work planned under this project was subordinated to the needs of the alloy casting program. All the alloy ingots cast were examined for grain size, and it was found that up to 4 atomic % of molybdenum causes a progressive but nonlinear decrease in the grain size of the as-cast ingot. A chromium alloy also showed grain refinement. The reduced grain size in all these alloys is considered to result from the low atomic mobility at the reduced temperature at which the bulk of the alpha phase is believed to form. Up to 0.7 atomic % of niobium does not affect the structure of as-cast uranium. Preliminary experiments on the application of mechanical vibration to the mould were ineffective. (auth)

17000 RDB(S)/TN-2126

Gt. Brit. Springfields Works, Springfields, Lancs, England.

OBSERVATIONS ON THE HEAT TREATMENT OF URANIUM. M. D. Jepson and W. Pollock. [1954?]. 13p.

Further studies of the effects of heat treatment on the structure and dimensional stability of cast uranium are reviewed. The retention of beta phase in quenched production bars is reported in some detail and discussed. (auth)

17001 RDB(W)/TN-223

United Kingdom Atomic Energy Authority. Industrial Group. Windscale Works, Sellafield, Cumb., England.

THE METALLOGRAPHIC EXAMINATION OF IRRADI-

ATED FUEL ELEMENTS. A Review of Progress to July 31, 1955. P. Leech, V. W. Eldred, J. Skinner, and D. Rhodes. Sept. 1955. 28p.

Equipment has been installed at Windscale for the preparation and metallographic examination of sections cut from irradiated thermal reactor fuel elements. The equipment and its operation are described and discussed, and its capabilities are illustrated by some typical photomicrographs. (auth)

17002 SCNC-271

Sylvania-Corning Nuclear Corp., Bayside, N. Y.
URANIUM DIOXIDE FUEL MATERIALS WITH IMPROVED THERMAL CONDUCTIVITY. H. Shapiro and R. M. Powers. June 1959. 22p. Contract AT-30-1-GEN-366. $0.75(OTS).

Metallic and ceramic materials were added to UO_2 fuel in thermal conductivity improvement experiments. Cermet-type fuel cores with the framework consisting of Mo or Nb and UO_2 were prepared. These cermets are favorable for better heat transfer but are unfavorable with respect to their neutron economy. Small amounts of ceramic additions, such as the oxides of Y or Nb, which form solid solutions with UO_2, improved the thermal conductivity of the fuel material, with very little effect on neutron economy. The formation of these solid solutions, the thermal conductivity test equipment, and the test procedures are described, and the preliminary test results are discussed. (auth)

17003 TID-4005(Pt.1, 5th ed.)

Division of Research, AEC.
SUMMARIES ON PHYSICAL RESEARCH IN METALLURGY, SOLID STATE PHYSICS, AND CERAMICS. Ralph R. Nash, ed. July 1959. 207p. $2.75(OTS).

The objectives and current status of the individual research projects supported by the Metallurgy and Materials Branch, Division of Research, in the fields of physical metallurgy, solid state physics, and physical ceramics are summarized. Included is the research conducted at the Commission's laboratories as well as that performed at university and other laboratories. The information was organized into three broad categories; production treatment and properties of materials, physical research in the nature of matter, and the interaction of radiation with matter. (W.L.H.)

17004 TID-8505

Civilian Reactor Fuel Element Review Group, AEC.
REPORT ON CIVILIAN REACTOR FUEL ELEMENTS. June 1959. 191p. $1.75(OTS).

The development of fuel elements for pressurized and boiling water reactors, organic-cooled reactors, sodium-cooled thermal reactors, fast breeder reactors, and gas-cooled reactors is discussed. The development of metallic, ceramic, and cladding materials for reactor fuel elements is reported. Fabrication, chemical processing, irradiation testing, and fuel cycle economics for reactor fuel elements are discussed. (W.L.H.)

17005 WADC-TR-56-267(Pt. II)

Koppers Co., Inc., Pittsburgh.
EVALUATION OF DESIGNS AND MATERIALS FOR HIGH SPEED-HIGH TEMPERATURE SHAFT SEALS FOR TURBOJET ENGINE APPLICATIONS. John J. Brenza, John H. Fuchsluger, Glenn F. Hyde, and Ernest J. Taschenberg. Dec. 31, 1958. 94p. Project title: GAS TURBINE TECHNOLOGY. Task title: HIGH TEMPERATURE RUBBING SEALS. Contract AF33(616)-5015.

The demand for higher performance aircraft engines has resulted in increases in engine operating temperatures and pressures. In turn, this has necessitated the adoption of new shaft seal materials and refinement in shaft seal design. This development program was undertaken to develop rubbing seals that would operate for 1000 hours, at 1000°F, and at a rubbing speed of 30,000 feet per minute. Accordingly, new materials were investigated; these materials were incorporated in seals; and their performance as seals was evaluated. In all, one hundred and sixty-three materials were screened on the basis of room temperature and 1000°F, dry, rubbing, wear tests and 1000-hour, 1000°F oxidation tests. Material combinations found to be promising were next evaluated as seals under increased operating conditions, and eventually under conditions duplicating those existing in a jet engine. (auth)

17006 WADC-TR-58-655

Wright Air Development Center. Materials Lab., Wright-Patterson AFB, Ohio.
AIR RESEARCH AND DEVELOPMENT COMMAND TECHNICAL SYMPOSIUM [HELD AT] STATLER-HILTON HOTEL, DALLAS, TEXAS, JULY 9-10, 1958. Dec. 1958. 501p. (PB-151627). $7.00(OTS).

The subjects covered by the papers presented at this symposium are: propulsion materials, structural materials, special purpose materials, electronic materials, and materials research. (W.L.H.)

17007 WAL-TR-405-7/1

Watertown Arsenal Lab., Mass.
HOT-PRESSED AND ROLL-REDUCED COMPACTS OF ALLOY Ti–6%Al–4%V POWDER RECOVERED FROM WROUGHT METAL SCRAP. S. V. Arnold. June 1959. 25p. D/A Project 5B93-32-003. (AD-217828).

Massive scrap of alloy Ti–6%Al–4%V was embrittled with hydrogen and comminuted to powder of metallurgical quality. Compacts of this powder, hot pressed to theoretical density, closely approximated the original composition in chemistry. Whereas tensile properties of the hot-pressed compacts showed equivalent strength and somewhat lower ductility, compacts hot-roll-reduced developed higher strengths and ductility than the commercial mill-annealed wrought metal. Sustained loading at 800°F to a stress of 65,000 psi for 150 hours caused age hardening to circa 200,000 psi tensile strength with 7% elongation. (auth)

17008 WAPD-ZH-18

Westinghouse Electric Corp. Bettis Plant, Pittsburgh.
ZIRCONIUM HIGHLIGHTS. June 1959. 26p. Contract AT-11-1-GEN-14. $4.80(ph), $2.70(mf) OTS.

A preliminary summary is presented of information on the low-cycle strain fatigue properties of vacuum-melted Zircaloy-2. A statistical study is presented of the effects of heat treatment on the tensile properties of Zircaloy-2. The corrosion resistance of Zircaloy-2 alloys containing 14, 34, 44, 57, 63, and 78 wt. % Cu was investigated. Data are presented on argon vs. helium shielded welds on Zircaloy-2. (For preceding period see WAPD-ZH-17.) (W.L.H.)

17009 WCAP-1162

Westinghouse Electric Corp. Atomic Power Dept., Pittsburgh.
THERMOELECTRIC NUCLEAR FUEL ELEMENT. Annual Progress Report. J. C. Danko, A. Biancheria,

F. L. Carter, R. R. Ferber, A. E. Fein, H. M. Ferrari, W. D. Johnston, G. R. Kilp, and G. L. Thomas. Apr. 15, 1959. 113p. Contract AT(30-3)-500. $2.50(OTS).

Lithium-doped nickel oxide pellets were prepared for a mixed valence characteristics study. Data are given on thermoelectric properties of $Li_xNi_{1-x}O$ as a function of Li concentration and temperature as well as Seeback coefficient and electrical resistivity. Mixed-valence compounds utilizing UO_2 were prepared, and electrical resistivity as a function of temperature for $M_xU_{1-x}O_2$ thermoelectric materials is given (where M is the non-transition metallic additive possessing any valence except +4). In addition, data are given on the electrical properties of such systems as those represented by the formulas $Na_xB_{1-x}UO_3$, $La_xBa_{1-x}TiO_3$, $Y_xCa_{1-x}TiO_3$, $Ca_xY_{1-x}VO_3$, $Na_xMn_{1-x}Te$, and US_x. Cerium oxides are also being investigated. Preparation methods and properties of cerium sulfides are reported, and data on Seeback coefficients, resistivities, thermal conductivity, and high temperature thermoelectric properties are presented. Developments in fabrication techniques for thermoelectric materials are described. Flame spraying has so far been unsuccessful, while encouraging results are reported for swaging. Development of pressing techniques is discussed, and data from powder binder studies are tabulated. A promising powder rolling technique is reported. Physical and chemical characteristics of thermoelectric materials such as $Li_xCu_{1-x}O$ and $Li_xNi_{1-x}O$ systems are being investigated. Results of corrosion tests on these materials in high-temperature pressurized water are presented along with data on compressive strength and thermobalance tests in air. Data are presented on behavior of Li–Ni–O pellets heated in stainless steel, Inconel, and quartz bombs. These tests were aimed at evaluating the behavior of thermoelectric materials in contact with cladding. Bonding studies are reported for both the Li–Cu–O and Li–Ni–O systems, and results of bonding tests with cladding materials such as Al, Cu, stainless steel, and Zircaloy-2 are given for the Li–Cu–O system. However, no bonding techniques developed to date have the high-temperature range desired for the Li–Ni–O system. Data on insulator studies indicate that MgO, Al_2O_3, and ZrO_2 could be used in contact with the Li–Ni–O system at 1100°C. The design and construction of an apparatus for pre- and post-irradiation measurements of electrical resistivity, thermal conductivity, and Seeback coefficient on thermoelectric materials are reported, and a design description of the apparatus, with certain modifications, is presented. Also, a design description of a Van De Graaff apparatus to be used in measuring the effects of electron bombardment on the Seeback coefficient, thermal conductivity, and electrical resistivity of these materials is presented. Results of preliminary tests to determine the effects of electron bombardment on the properties of Li–Ni–O systems are presented. In-pile measurements of radiation effects are in progress at BNL. Finally, a design description is given of an apparatus constructed to measure the thermoelectric parameters of materials and to evaluate bonding techniques on these materials. (J.R.D.)

17010 CEA-tr-A-514

SUR QUELQUES PROBLÈMES FONDAMENTAUX CONCERNANT LA FORMATION ET D'ADHÉRENCE DE L'OXYDE SUR LE FER. (Some Fundamental Problems Concerning the Formation and Adherence of Oxide on Iron.) H. Engell and F. Wever. Translated into French from Acta Met. 5, 695-702(1957). 23p.

The oxidation of iron and the adherence of the oxide layer to the metal surface were investigated using rectangular, spiral, and wire samples in the temperature range from 600 to 850°C. The tests showed that in this temperature range iron diffuses almost entirely in the Wüstite (FeO). The cohesion of the iron and oxide is maintained by a creep phenomenon of the oxide layer perpendicular to the sample surface. The creep is inhibited at corners and ridges of the sample. During oxidation of spirals the creep phenomenon produces a curling of the spirals. In oxidation of iron wires, the cylindrical form of the oxide layers impedes the oxide creep. At temperatures higher than 850°C and in the case of thick oxide layers, a diffusion of the oxygen into the Wüstite appears. The oxide has a highly inflated structure in the vicinity of the iron/Wüstite interface at these temperatures. (J.S.R.)

17011 CTS-587

INVESTIGATION OF THE PHASE DIAGRAM FOR THE ZIRCONIUM–BORON SYSTEM. (K Issledovaniyu Fazovmnoi Diagrammy Sistemy Tsirkonii-bor.) V. A. Epel'baum and M. A. Gurevich. Translated for Dept. of Scientific and Industrial Research, London from Zhur. Fiz. Khim. 31, 708-11(1957). 7p. Price £1.12s. (United Kingdom) £2. (Overseas) DSIR.

The boron–zirconium system was investigated by radiographic and chemical methods. It was shown that a solid solution of boron in hexagonal and α-zirconium up to 2 at. % boron forms, while the identity periods for the lattice of the original zirconium were increased from a = 3.232 A, c = 5.140 A, c/a = 1.590 to a = 3.253 A, c = 5.191 A, c/a = 1.596. (auth)

17012

A CORRELATION OF DATA ON DIFFUSION OF SOLUTES IN FACE-CENTERED CUBIC METALS. D. Turnbull and R. E. Hoffman (General Electric Co. Research Lab., Schenectady, N. Y.). Acta Met. 7, 407-10(1959) June.

It is shown that the available data on the diffusion coefficients of substitutional solutes B in dilute face-centered cubic solutions in A can be described approximately by the equation:

$$\Delta F'_B - \Delta F'_A = \frac{Q_A}{4} \frac{U_A - U_B - \overline{\Delta U}_{AB}}{U_A}.$$

$\Delta F'_B$ and $\Delta F'_A$ are the free energies of activation for solute and solvent diffusion at the melting point of the pure solvent; Q_A is the activation energy for self-diffusion in pure A; U_A and U_B are the cohesive energies of pure A and pure B respectively and $\overline{\Delta U}_{AB}$ is the heat of solution of B in A. This correlation, though not in strict accord with the nearest neighbor model for solutions, was suggested by it. (auth)

17013

EFFECT OF DISPERSITY OF GRAPHITE AND HEAT TREATMENT ON THE MECHANICAL PROPERTIES OF CAST IRON WITH IRREGULAR VOLUME COMPRESSION. V. K. Titov and E. F. Makarov (Nikolaev Shipbuilding Inst., Ukrainian S.S.R.). Dopovidi Akad. Nauk Ukr. R.S.R. No. 3, 286-9(1959). (In Russian)

The effect of the dispersity of graphite and heat treatment on the mechanical properties of cast iron under conditions of soft loading, which practically imitates contact application of loads, is discussed. B. D. Grozin's methods were employed in this study. Experiments showed that grinding graphite increases the value of the stresses, causing equal deformations. Heat

treatment is most effective with cast irons containing fine graphite. (auth)

17014

MECHANICAL AND TECHNOLOGICAL PROPERTIES OF BERYLLIUM. Hans-Richard Meininghaus. Atomkernenergie 4, 231-2(1959) June. (In German)

A brief outline of the mechanical strength and stretch properties is presented. Some details of the powder metallurgy, rolling, and extruding of the metal is provided. Problems arising from welding and soldering are described. The corrosion resistance properties of beryllium are briefly mentioned. (auth)

17015

ELECTROCHEMICAL BEHAVIOR OF 18-8 AUSTENITIC STAINLESS STEEL WITH MOLYBDENUM IN SULFURIC ACID SOLUTION. Phillippe Berge. Compt. rend. 248, 3557-9(1959) June 22. (In French)

Polarization curves of austenitic 18-8 stainless steel and 18-8 containing 3% Mo show the generally favorable effect of Mo on corrosion in sulfuric media. The 18-8 with Mo was definitely more passive. This may be because of the faster formation of an oxide layer. (T.R.H.)

17016

CHARACTERISTIC ASPECTS AND DIFFERENCES BETWEEN DEFORMATION BY DRAWING AND DEFORMATION BY ROLLING; ROLE OF GRAIN JOINTS AND SUBJOINTS. Aurel Berghezan. Compt. rend. 248, 3560-4(1959) June 22. (In French)

The differences between deformation by drawing and by rolling were analyzed using the technique of decoration of dislocations by precipitation. The role of grain joints is especially important during deformation by drawing, particularly at the beginning. (tr-auth)

17017

THE UNIFORM CHARACTER OF STRUCTURAL HARDENING IN THE ALUMINUM–NICKEL SOLID SOLUTION. Henry Martinod and Jean Calvet. Compt. rend. 248, 3708-13(1959) June 29. (In French)

Partial isothermal hardening affects the series of phenomena at another temperature in a continuous manner. A reversion is produced. It appears progressively as a function of thermal conditions and speeds up the subsequent evolution at low temperature. These facts support the hypothesis of double decomposition of the solid solution of the same nature in a large interval of temperature. (tr-auth)

17018

CORROSION RESISTANCE OF TITANIUM AND ZIRCONIUM IN CHEMICAL PLANT EXPOSURES. P. J. Gegner and W. L. Wilson (Columbia-Southern Chemical Corp., Barberton, Ohio). Corrosion 15, 341t-50t(1959) July

Corrosion tests were conducted with titanium, zirconium, and a number of other metals in a wide variety of chemical plant exposures. Some of the tests were carried out under similar conditions in as many as five different plants. Titanium was found to possess low or, in many cases, nil corrosion rates in such varied exposures as wet chlorine gas, hypochlorous acid, sodium and calcium hypochlorites, sodium and potassium chlorides, sea water, and a number of solutions containing wet chlorine. It was also found to be very resistant to many concentrations of calcium chloride, sodium and potassium hydroxides, nitric acid, and chlorine-saturated sulfuric acid. Zirconium exhibited low corrosion rates in nitric acid, sodium and potassium hydroxides, hydrochloric acid, dry chlorine, sodium hypochlorite, sodium and potassium chlorides, sea water, and some concentrations of calcium chloride and chlorine-saturated sulfuric acid. Results of 116 exposures involving over 800 corrosion rates on 40 different materials are described. (auth)

17019

ON THE EFFECT OF COMPRESSIVE STRESSES ON SHRINKAGE IN SINTERING OF POROUS BODIES. I. M. Fedorchenko and R. O. Andrievskii (Inst. of Metaloceramics and Special Alloys, Academy of Sciences, Ukrainian S.S.R.). Dopovidi Akad. Nauk Ukr. R.S.R. No. 3, 281-5(1959). (In Russian)

Results are presented of a study of the effect of uneven compressive stresses on volume shrinkage of sintered bodies consisting of silver, copper and nickel powders (T = 600—800°C, t = 5 minutes). The dependence of the shrinkage on the stress, allowing for the geometrical factor, proved to be nonlinear in the case of annealed powders, which is due to plastic deformation arising on application of the load to the sintered body. The inference may be drawn that, under conditions of "free" sintering, the processes occurring are diffusion processes and not plastic strain. (auth)

17020

USE OF RADIOACTIVE ISOTOPES IN INVESTIGATIONS OF THE DIFFUSION AND THERMODYNAMIC CHARACTERISTICS OF SOLID SOLUTIONS. A. A. Zhoukhovitzky (Moscow Inst. of Steel). Intern. J. Appl. Radiation and Isotopes 5, 159-74(1959) May.

New techniques for determining diffusion and thermodynamic characteristics of solutions are discussed. Absorption methods (the "thick layer" and the "thin layer" methods) permit determination of diffusion coefficients whereby measurements of radiation absorption are not necessary. The impression method is an express method. The technique for determination of thermodynamic characteristics is based on exchange rate measurements. A non-isothermic method for the determination of diffusion characteristics and new techniques for measurements of the heat of dilution by the solubility to temperature ratio have been set forth during the last years. All methods were tested in a series of diffusion and thermodynamic measurements. (auth)

17021

METHODS OF STUDYING SELF-DIFFUSION IN METALS BY MEANS OF RADIOISOTOPES. Claude Leymonie and Paul LaCombe (Centre de Recherches Métallurgiques de l'École des Mines, Paris). Intern. J. Appl. Radiation and Isotopes 5, 175-96(1959) May.

The use of radioactive isotopes has enabled self-diffusion coefficients in metals to be determined with progressively greater accuracy. This paper deals with the different methods in use at present for studying both general self-diffusion and intergranular self-diffusion. There is now a fairly wide choice of methods for general self-diffusion; that of examining sections is undoubtedly the most accurate, but in practice it is limited to the measurement of diffusion coefficients greater than 10^{-11}. For smaller values, absorption methods must be employed; in that case, the choice of method for solving a given problem depends above all on the radiation characteristics of the radioactive isotopes. The various absorption methods which have been used recently are examined, each one being illustrated by a specific example; particular emphasis has been laid on those methods in which careful choice of the

geometric parameters eliminates the need to know the absorption characteristics of the radiations. The choice of methods for studying intergranular self-diffusion is more limited; comparison of the values of concentration in the grain boundaries given by the theories of Fisher and of Whipple, respectively, is given prominence, and conditions are defined under which, by a simple application of Fisher's formula, the sectional method may be used to examine intergranular diffusion. (auth)

17022

IMPROVEMENTS IN THE USE OF RADIOTRACERS FOR STUDYING WEAR IN PISTON SEGMENTS. Jean Thiéry (Institut Français du Petrole, Rueil-Malmaison, France). Intern. J. Appl. Radiation and Isotopes 5, 197-203(1959) May.

By collecting the oil moving down to the sump in a gutter at the bottom of the liner, a great improvement in sensitivity is obtained. The difference between the activity of this oil and that of the sump oil, by which the ring belt area is fed, is continuously registered. The curve obtained represents the variations of instantaneous wear-rate, and by integrating the graph of oil volume versus activity, one can obtain the "apparent wear," as carried in the oil. A complete balance of wear in every possible direction (oil, rings, grooves, and exhaust) gives for different types of oil the coefficient to be applied to "apparent wear" to obtain "real wear," or total wear. (auth)

17023

THE TENSILE PROPERTIES OF HIGH-PURITY NIOBIUM AT LOW TEMPERATURES. B. F. Dyson, R. B. Jones, and W. J. McG. Tegart (Univ. of Sheffield, Eng.). J. Inst. Metals 87, 340-2(1959) June.

High-purity niobium has been tested over the range −196 to 240°C. Yield points were observed at all temperatures, the magnitude of the yield drop increasing with decreasing temperature. The temperature-dependence of the yield stress was similar to that of other body-centered cubic metals, and the material was ductile at −196°C. Some experiments on strain-aging are reported. The results suggest that oxygen is responsible for the observed repeated yielding and return of yield point on aging. (auth)

17024

THE THORIUM–ALUMINIUM SYSTEM. J. R. Murray (Atomic Energy Research Establishment, Harwell, Berks, Eng.). J. Inst. Metals 87, 349-52(1959) June.

The thorium–aluminum system has been investigated over the whole range of composition by thermal, x-ray, and metallographic methods. Six intermetallic compounds occur: Th_2Al, Th_3Al_2, and $ThAl_2$ are formed directly from the liquid, while ThAl, $ThAl_3$, and a compound of approximate composition Th_3Al_2 are formed by peritectic reactions. Th_3Al_2 and "Th_2Al_3" decompose eutectoidally at 1075 and 1100°C, respectively, whereas Th_2Al, ThAl, $ThAl_2$, and $ThAl_3$ are stable at room temperature. Aluminum is slightly soluble in thorium, the limits at 1300 and 1000°C being 0.85 and 0.4 at.%, respectively. Alloys of all compositions were stable in air at room temperature, provided that care was taken to prevent contamination by air or carbon vapor during melting or heat treatment. (auth)

17025

METALS FOR THE FUTURE, THE RARE EARTHS. R. B. Howes (St. Eloi Corp., Cincinnati). Metal Progr. 75, No. 6, 108-12(1959) June.

Properties and metallography of the rare earths are discussed. Discussions also cover use of the rare earths in the fields of nucleonics, electronics, and metallurgy. (C.J.G.)

17026

STUDIES ON THE OXIDATION OF ZIRCONIUM WITH AIR. Tatsuo Maekawa, Takuya Hata, and Yoshihiko Tachihara. Nippon Kinzoku Gakkaishi 22, 150-4(1958) Mar. (In Japanese)

The reaction kinetics of the Kroll-processed reactor-grade zirconium under 1 atm. of air was studied over the temperature range of 650 to 900°C. An analysis of the rate data showed that the cubic rate law was applicable in the initial stage of oxidation. However, a breakdown of the oxide film was observed at 800 and 850°C, and then the oxidation proceeded in accordance with the linear rate law. A plot of the logarithms of the cubic rate law constants against the reciprocal of absolute temperature gave a straight line, and the activation energy of 48,400 cal/mol was calculated. Chemical analysis was used for the determination of the amount of nitrogen absorbed during oxidation of zirconium in air. The contents of absorbed nitrogen in the oxide layer increased with oxidation time and temperature, but no existence of a ZrN phase was found by x-ray analysis. The experimental formula of absorption of nitrogen during the oxidation of zirconium in air, $W^{1/2} = kt$ (where W: weight of absorbed nitrogen, k: constant, t: time), is suggested. And the activation energy of 82,400 cal/mole was calculated for absorption of nitrogen during the reaction of zirconium with air, over the temperature range of 700 to 850°C. It is concluded that the rate-controlling step of the oxidation of zirconium is the process of diffusion of oxygen ion in the oxide film. (auth)

17027

ON THE VARIOUS PROPERTIES OF VACUUM-MELTED HEAT-RESISTANT NIMONIC 80A, S816 ALLOYS AND 13% CHROMIUM STAINLESS STEEL. Sadao Koshiba and Tuneo Kuno. Nippon Kinzoku Gakkaishi 22, 169-73(1958) Apr. (In Japanese)

Samples of heat-resistant Nimonic 80A, S816 alloys, and 13% Cr stainless steel were melted in vacuum, and their various properties were compared with specimens melted in open air. By vacuum melting of 13% Cr stainless steel, the gas contents and nonmetallic inclusions in steel were much decreased, and the mechanical properties at elevated temperature were improved. Particularly, the corrosion resistance, which is one of the most important properties for stainless steel, was remarkably improved by vacuum melting. Likely in the case of Nimonic 80A and S816, the gas contents and nonmetallic inclusions were eliminated by vacuum melting. Furthermore, the workability and the mechanical properties at elevated temperature, the rupture strength, and the oxidation resistance were improved. These results showed that beneficial effects can be brought about by application of the vacuum melting method. (auth)

17028

SINTERED INTERMETALLIC COMPOUND NiAl AS HIGH TEMPERATURE MATERIAL (1st Report). Yûnoshin Imai and Masuji Kumazawa. Nippon Kinzoku Gakkaishi 22, 244-8(1958) May. (In Japanese)

Sintering of the intermetallic compound NiAl, which has favorable high-temperature properties, oxidation resistance, thermal shock resistance, stable crystal structure, and high melting point (1650°C), was studied.

The density, porosity, volume change, hardness, and expansion coefficient were measured, and the microscopic structure was examined. The most suitable conditions for sintering were compacting pressure of 4 to 7 t/cm^2, sintering temperatures of 1400 to 1450°C, and sintering time of 3 to 5 hr in vacuum at 10^{-4} mm Hg. (J.E.D.)

17029

SINTERED INTERMETALLIC COMPOUND NiAl AS HIGH TEMPERATURE MATERIAL (2nd Report). Yûnoshin Imai and Masuji Kumazawa. Nippon Kinzoku Gakkaishi 22, 248-50(1958) May. (In Japanese)

In order to determine the physical and mechanical properties of sintered NiAl, oxidation resistance, axial rupture by compression, transverse rupture by bending, and absorption energy by Charpy test were examined. The following experimental results were obtained: the oxidation resistance of sintered NiAl was stronger than N-155, and sintered CoAl; NiAl cold-pressed at 5 t/cm^2, sintered at 1400° for 5 hr, was fractured by compression at 15 ton/cm^2. The value of absorption energy was generally increased when the testing temperatures rose over 600°. (auth)

17030

CREEP OF ZIRCONIUM. Hideharu Ohara. Nippon Kinzoku Gakkaishi 22, 250-3(1958) May. (In Japanese)

Creep tests on reactor-grade zirconium for 1000 hours were carried out under the stresses of 8, 12, 16, and 20 kg/mm^2 at temperatures from 250 to 500°C in argon atmosphere. The creep rates obtained were from 8×10^{-5} to 34%/hr. The activation energy for creep was 78.0 kcal/mole for zero stress. (auth)

17031

ON THE RECRYSTALLIZATION OF ALUMINUM ALLOYS CONTAINING ZIRCONIUM. Satoshi Kugasa. Nippon Kinzoku Gakkaishi 22, 269-73(1958) May. (In Japanese)

The effect of zirconium on the recrystallization behavior of cold-rolled aluminum, aluminum−2% copper alloy, and aluminum−2% magnesium alloy has been studied by means of hardness tests and microscopic methods. The results obtained are as follows: (1) The recrystallization temperature was elevated remarkably with increase of the amount of alloying zirconium till the content reaches about 0.3 or 0.5% in aluminum and aluminum−magnesium alloy, independent of the change of the temperature of preliminary annealing before final cold-rolling, and in aluminum−copper alloy upon preliminary annealing at a comparatively low temperature. When the content of zirconium was more than 0.3 to 0.5%, however, the recrystallization temperature was decreased gradually for aluminum and was almost same for aluminum−copper and aluminum−magnesium alloys. (2) The recrystallized grain size after final annealing for each system of alloys become progressively finer with addition of more zirconium till the content reaches about 0.3%. In the specimens with zirconium of more than this content, however, the recrystallized grain size was fairly fine and almost constant against the change of final annealing temperature as well as cold reduction and was also free of influence from the variation of the preliminary annealing temperature. (3) Recrystallization diagrams for Al−Zr, Al−Cu−Zr, and Al−Mg−Zr alloys have been proposed, based on the determination of the grain size as a function of rolling reduction and annealing temperature. (auth)

17032

RAPID VOLUMETRIC DETERMINATION OF ZIRCONIUM IN FERRO-ZIRCONIUM ALLOYS WITH CUPFERRON. Shigeo Wakamatsu. Nippon Kinzoku Gakkaishi 22, 359-62(1958) July. (In Japanese)

A simple and rapid procedure for the volumetric determination of zirconium in iron−zirconium alloys has been investigated. Zirconium can be titrated directly with standard cupferron solution using iron(III) as indicator. The titration is carried out in a 25% sulfuric acid solution containing iron(III) and ethyl ether, and after the reaction between zirconium and cupferron is complete, iron(III) is precipitated with cupferron as ferric cupferrate. The endpoint of titration can be detected by color change of ethyl ether layer with ferric cupferrate in the presence of precipitate of zirconium cupferrate. This simple procedure has only few interferences and can usually be applied with a minimum preliminary treatment after dissolving the sample in sulfuric acid and ammonium fluoride, which are efficient solvents for iron−zirconium alloys. Fluoride interferes in this method but can be removed easily by fuming with sulfuric acid and boric acid. (auth)

17033

EFFECT OF ALUMINUM, TIN AND MOLYBDENUM ON THE HOT-HARDNESS OF ZIRCONIUM. Yuzo Hosoi and Norio Nagata. Nippon Kinzoku Gakkaishi 22, 367-70(1958) July. (In Japanese)

In order to improve the strength of zirconium at elevated temperatures, the binary alloys of zirconium with aluminum, tin, and molybdenum were melted in nonconsumable argon arc furnace, and their hot hardness investigated. The results obtained are summarized as follows: (1) About 3% of tin or 4% of molybdenum, at least, has to be added to zirconium in order to improve the strength of zirconium at elevated temperature. On the other hand, addition of 2% of aluminum hardens zirconium more than any of the above elements. Generally, below 400°C, molybdenum is the most effective among the three in hardening zirconium, but above 600°C, aluminum is the most effective. (2) By quenching from the α range, the alloys are hardened less than by slow cooling them from the same temperature. On the contrary, by quenching from the β range, they are hardened more. (3) The hot hardness of alloys which are slow cooled decreases with increasing temperature, but there is an abnormal hardening range between 300 and 400°C in the Zr−Mo alloys when quenched from 900°. A similar phenomenon is also found in the case of tempered Zr−Mo alloys after quenching at the same condition, that is, the hardness rises to the maximum at about 400°C. It seems that these phenomena are related with the precipitation of the ω in β phase reported by H. A. Robinson et al. (auth)

17034

THE CORROSION CHARACTERISTICS OWING TO URANYL SALT SOLUTION AND THE CHANGES OF MECHANICAL PROPERTIES OF SOME AUSTENITIC STAINLESS STEELS. Gunji Shinoda, Tadao Sano, and Tadashi Kawasaki. Nippon Kinzoku Gakkaishi 22, 500-3 (1958) Oct. (In Japanese)

A study was made to examine the corrosion characteristics caused by uranyl salt solution, the effect of mechanical stresses on it, and the effect of corrosion on mechanical properties of some austenitic stainless steel. The results were as follows: (1) After the speci-

mens were heated for 100 hr at 680°C, carbide precipitation was more pronounced in Type 316 L steel containing Mo and Cu than the others, while stainless steel containing Nb has shown always a high corrosion resistance. (2) While the tensile strength of the specimens was unaffected by corrosion, a considerable decrease in their yield point and elongation resulted owing to corrosion, and this tendency was more remarkable in the specimens containing Mo and Cu except the specimen 30A containing Nb. (3) The effect of mechanical stresses on the corrosion characteristics was examined by an auto-radiograph of corroded specimens, and it was found that resistance to stress-corrosion of the specimen containing Mo and Cu is inferior to that of the specimen containing Nb. The corrosion resistance of Nb stabilized steel appears to be almost unaffected by imposed stresses. It may be reasonable to conclude that Mo and Cu in stainless steel are unfavorable for corrosion due to uranyl salt solution while Nb is always beneficial to corrosion characteristics of stainless steel. (auth)

17035

STUDY ON CORROSION OF AUSTENITIC STAINLESS STEEL BY URANYL SALT SOLUTION. Gunji Shinoda, Tadao Sano, and Tadashi Kawasaki. Nippon Kinzoku Gakkaishi 22, 592-6(1958) Nov. (In Japanese)

Applying surface radioactivity measurement, an autoradiographic method, and a weight-loss method, the corrosion resistance of some austenitic Cr–Ni steels against uranyl salt solution has been investigated. It was concluded that the count number and the autoradiographic method are useful to study the initial stage of corrosion mechanism. An x-ray diffractometer study was also made on welded specimens to examine the carbide precipitation and the ferrite formation, and the Nb carbide precipitated in the matrix was easily detected by an x-ray diffractometer study. The relative abundance of Nb carbide is less in the welded portion than in the other portion of base metal, and in the welded specimens there is no ferrite phase. Niobium-stabilized steels always show good corrosion resistance against uranyl salt solution. Some of the specimens were neutron-irradiated ($10^{12}cm^2$/sec, 8 Mev) at about room temperature, and the irradiated specimens showed no change in the structure and the corrosion characteristics. (auth)

17036

THE BEHAVIOUR OF DIE LUBRICANT IN DIE-CASTING PROCESS. Seita Sakui, Hidehiko Orii, Akira Ono, and Kazuwo Sumino. Nippon Kinzoku Gakkaishi 22, 617-21(1958) Dec. (In Japanese)

The behavior of die lubricant during casting in a die-casting process has not been fully investigated. Small amounts of HCl solution of radioactive H_3PO_4 were added to the die lubricant mechanically, and the radiographs of the surface and the inner part of the casting were taken after solidification. Comparatively large amounts of radioactive lubricant were applied. Zinc alloy ZAC No. 1 was cast in the dies. The results obtained were as follows: (1) The lubricant travelled with the flow front of the molten metal through the die cavity and accumulated at the place where the movement of molten metal came to end or remarkable turbulent motion occurred. (2) A large amount of lubricant was entrapped in the casting and distributed comparatively uniformly. (3) The chilled layer of casting occluded hardly any particles of the lubricant. (4) The entrapping of lubricant increased with the rise of casting temperature and with the increase of gate area. (auth)

17037

RADIOMETRIC TITRATION OF NIOBIUM AND TANTALUM IN STEEL. II. STUDIES ON ANALYTICAL METHODS FOR TRACE ELEMENTS IN METALS USING RADIOACTIVE ISOTOPES. Hiroshi Amano. Nippon Kinzoku Gakkaishi 22, 625-8(1958) Dec. (In Japanese)

The methods of determination and separation of Nb and Ta in steels were studied using the radioactive isotopes Nb^{95} and Ta^{182} as tracers and radioactive indicators. It was found from experience that the perchloric acid hydrolysis separation method was most superior for separating Nb and Ta from Fe and that after a single separation from Fe, Nb, and Ta could be successfully titrated with cupferron solution using Ta^{182} as the radioactive indicator. (auth)

17038

ON THE OXIDATION-RESISTANT PHOSPHOR ZIRCONIUM ALLOY (1st Report). Jin-ichi Takamura and Yasuo Sasaki. Nippon Kinzoku Gakkaishi 22, 663-8 (1958) Dec. (In Japanese)

This study was undertaken in an effort to provide a clearer picture of the oxidation mechanism whereby nitrogen reduces the heat resistance of zirconium and also to develop a new heat-resistant zirconium alloy containing a small amount of phosphorus. The oxidation test was carried out in dry oxygen and in air at temperatures of 700 to 900°C using the weight-gain method. Since the oxidation process of zirconium has been explained by the diffusion of negative ion vacancies through the oxide, the factors determining the concentration and the mobility of the vacancies require further examination. They are the valency, the ionic radius, and the ionization potential of the alloying element and the electroneutrality in the oxide lattice. Under such considerations, phosphorus was chosen for the alloying element. The results obtained are as follows: (1) Addition of a small amount of phosphorus counteracts the harmful effect of nitrogen in zirconium and exceedingly prolongs the breakaway period. It is noted that there is an optimum content of phosphorus. The amount ranges from 0.03 to 0.06 wt. % according to the purity of zirconium. The beneficial effect may be attributed to the solution of phosphorus in ZrO_2 lattice as P^{5+}, with consequent reduction of the concentration and the mobility of negative ion vacancies. An excess amount of phosphorus is harmful. (2) The exponent n for the equation of the oxidation process was obtained in pure zirconium and phosphor zirconium alloys. The activation energies of 38,000 and 34,000 cal/mole were determined for pure zirconium in dry oxygen and air, respectively. (auth)

17039

ISOTOPE TECHNIQUES FOR INSPECTION AND EVALUATION OF SHIP WELDS. E. L. Criscuolo (U. S. Naval Ordnance Lab., Silver Spring, Md.). Welding J., (N. Y.) 38, 324s-8s(1959) Aug.

Radiographic techniques utilizing Tm^{170}, Ir^{192}, Cs^{137}, and Co^{60} were explored for the inspection of welds in ½- to 2-in. steel plate. The information is presented in the form of technique and sensitivity curves. An analysis of these data has been performed and an empirical method has been developed to determine the optimum technique for a given thickness of material. For the inspection of welds in ½- to 1-in. thickness range, iridium is the most promising isotope although other isotopes may be used satisfactorily. A review of data

accumulated by the Ship Structure Committee on flaw evaluation is also presented. (auth)

17040

WELDING OF FUELS AND CONTROLS FOR DRESDEN NUCLEAR POWER STATION. C. N. Spalaris and J. W. Weyers (General Electric Co., San Jose, Calif.). Welding J., (N. Y.) 38, 760-5(1959) Aug.

The processes, materials, and quality-control methods are described for fabricating Zircaloy-2 clad, uranium dioxide containing fuel elements and boron-bearing stainless-steel control rods. Certain unique techniques were required in handling Zircaloy-2 in order to preserve its satisfactory corrosion resistance and favorable mechanical properties. Certain developmental aspects of end-closure welding are described. Welding of boron-bearing stainless-steel control rods required special weld-junction geometries and techniques to overcome material brittleness and distortion. (auth)

17041

WELDED CLAD STEEL PIPE FOR REACTOR CONSTRUCTION. William H. Funk (Lukens Steel Co., Coatesville, Penna.). Welding J., (N. Y.) 38, 766-71 (1959) Aug.

Welding procedures to ensure strength and corrosion resistance of welded stainless-clad steel pipe for nuclear reactors were tested. Results indicate that under production conditions normally existing in a field welding project, predictable and satisfactory weld joints may be made on clad steel pipe. Both strength and corrosion-resistance characteristics required can be obtained without need for unusual quality-control procedures. These welding procedures are applicable to Inconel-clad pipe. Welding procedures are given and weld cross sections shown. (C.J.G.)

17042

ANTI-CORROSION MANUAL, 1959 EDITION. London, Corrosion Prevention and Control, 1959. 404p.

The subjects covered in this manual are: theory of corrosion, corrosion in industry, resistant materials and their applications, preparatory treatments for protective coatings, protective coatings, pipe coatings and tapes, protective packaging, boiler water treatments, and specifications and patents. (W.L.H.)

PARTICLE ACCELERATORS AND HIGH-VOLTAGE MACHINES

17043 CF-58-10-99

Oak Ridge National Lab., Tenn.

MEASUREMENT OF CARBON ARC DENSITY. M. L. Halbert, C. E. Hunting, and A. Zucker. [Oct. 1958]. 11p. Contract [W-7405-eng-26]. $3.30(ph), $2.40(mf) OTS.

The density of carbon arc was investigated by elastic scattering of 28-Mev N ions from the ORNL 63-inch cyclotron. The apparatus and method are described, and a discussion of results is presented. If the excess of three counts above background was real and not due to noise, the probable density of the arc is 1.1×10^{14} atoms/cm^3. Applying a Poisson distribution, a series listing the probability of 3 coincidences as a function of density is given. (J.R.D.)

17044

CONSIDERATIONS ON THE CONSTRUCTION OF A HELIX LINEAR ACCELERATOR FOR PROTONS. W. Müller and J. Rembser (Universität, Frankfurt). Nuclear Instr. & Methods 4, 202-12(1959) May. (In German)

The method of accelerating heavy particles in a helix waveguide as repeatedly suggested in literature has been examined theoretically in detail. The first part of this article deals with the HF-characteristics of the wave-guide that were taken from known investigations based on the Pierce theory. A more accurate examination of the acceleration process for protons shows that the accelerating electric field strength on the axis of the helix is strongly reduced for proton energies larger than ~ 30 Mev, while for proton energies smaller than ~ 0.5 Mev the losses in the waveguide are considerably increasing. An acceleration, therefore, will only be advisable for a medium energy range, but here it is equivalent if not superior to other methods. In the case discussed here (acceleration of protons from 1 to 10 Mev) the optimum vacuum wave length was found to be ~ 1.5 m. With a HF source output of 0.5 Mw such an accelerator would have a length of ~ 12 m, while the diameter of the shield would be 12 cm, the volume being about 0.15 m^3. (auth)

PHYSICS AND MATHEMATICS

General

17045 AECU-4117

RAND Corp., Santa Monica, Calif.

RELATIVISTIC SELF-CONSISTENT CALCULATION FOR THE NORMAL URANIUM ATOM. Stanley Cohen. Feb. 10, 1959. 66p. Contract AT(11-1)-135, Project Agreement No. 5. (RM-2372-AEC).

The relativistic self-consistent solution for the normal uranium atom is presented. A comparison is made between the energy eigenvalues for each of the subshells with corresponding experimentally determined energy-term values. (J.E.D.)

17046 AECU-4250

[Los Alamos Scientific Lab., N. Mex.]

A NUCLEAR-ELECTRIC PROPULSION SYSTEM. R. W. Bussard. [1956]. 11p. Contract [W-7405-eng-36]. $3.30(ph), $2.40(mf) OTS.

An analysis of the potentialities of particle accelerators as thrust producers and the correlation of their performance with other components of a complete, self-contained system as required for free-space operation are discussed. It is shown that the accelerator thrust per unit area, as limited by space-charge, is completely independent of particle mass, charge, or charge-to-mass ratio and depends only upon the gradient of the accelerating field. (A.C.)

17047 AFOSR-TN-59-551

Utah. Univ., Salt Lake City. Inst. of Metals and Explosives Research.

ELECTRICAL FIELDS AND ELECTROMAGNETIC RADIATION FROM CHEMICAL EXPLOSIONS. R. T. Keyes. Mar. 19, 1959. 56p. Contract AF18(603)-100. (AD-216691).

Electrical fields and electromagnetic radiation generated by chemical detonations of charges ranging in size from 10g to roughly 25 kg were investigated over a frequency range extending from a few cycles per second to 500 megacycles per second. The electrical energy in all cases was found to cover a broad band of frequencies with the largest potentials occurring in a frequency range below a few hundred cycles per second.

Little of the low frequency signals were radiated. Megacycle range signals (predominately radiation) were found to occur in the form of short random bursts. A non-reproducible delay the order of several hundred microseconds was found to exist between the time of detonation and the appearance of the first bursts of radiation. The electrical potentials of the expanding explosion products were estimated, and for a 552g 50/50 pentolite charge the maximum value was determined to be 18,000 volts. For bare charges this quantity was considered to vary roughly in direct proportion to the charge weight. Experiments are described which were performed to ascertain the mechanism whereby the electrical fields and EM radiation are generated by chemical detonations, and a model is proposed. (auth)

17048 AFOSR-TN-59-630

Maryland. Univ., College Park.

AN ATTEMPT AT UNIVERSAL FOUR-FERMION INTERACTION. Technical Report No. 139. J. C. Pati and S. Oneda. June 1959. 47p. Contract AF49(638)-24.

An attempt is made to explain the various decays of strange particles on the basis of vector and axial-vector four-fermion interaction. The existence of (V + A) currents as well as (V − A) currents is considered as a possibility and the interaction is assumed to have the form $f(J_a^+ J_a^{+*} + J_a^- J_a^{-*}) + h.c.$, where f is the coupling constant, J_a^- is composed of all charged currents which have negative chirality, $\bar{A}\gamma_a(1+\gamma_5)B$, and J_a^+ of those charged currents which have positive chirality, $\bar{C}\gamma_a(1-\gamma_5)D$. The leptonic currents necessarily belong to the J_a^- group since the neutrino has a negative helicity. The appropriate assignment of chiralities to various possible charged baryonic currents was studied in order to explain the characteristics of hyperon decays in the framework of global symmetry for the pion interactions. The virtual pionic or kaonic effects outside the loop are neglected. It turns out that there are three solutions which can explain reasonably well the branching ratios and asymmetry parameters of hyperon decays. One of the solutions seems to be the best since it explains rather well the rates of hyperon decays and $\pi \rightarrow \mu + \nu$ decay at the same time. Signs of asymmetry parameters of hyperon decays are important to distinguish these solutions. However, the problem of the K-meson (K^+ and K^0) decays into two pions is not easy to explain unless we impose high symmetry also for the strong K-meson interactions. Furthermore, the occurrence of the $\Sigma^+ \rightarrow n + e^+ + \nu$ decay is predicted which would give a direct test of the attempt. If one introduces neutral baryonic currents also, there is a way to explain the hyperon decays as well as the two pion decays of K-meson interaction and also the $\Sigma^+ \rightarrow n + e^+ + \nu$ decay could be forbidden. (auth)

17049 BNL-536

Brookhaven National Lab., Upton, N. Y.

NUCLEAR ENGINEERING DEPARTMENT PROGRESS REPORT [FOR] JULY 1–SEPTEMBER 30, 1958. F. Maslan, ed. 76p. $2.25(OTS).

The study of effective resonance integrals in a heterogeneous system was continued. Measurement of the buckling and reflector savings of the 0.250-in.-diam. rod, water-moderated lattices was completed for both 1.027 and 1.5% enriched U metal. Chemistry and Chemical Engineering Division. Investigation of the U–Bi system was continued by means of emf measurements on cells. A series of experiments involving the sorption of active Sm on graphite was completed. The quartz Bodenstein gage was used to measure the vapor pressure of BiI_3 in the temperature range 330 to 525°C. The equilibria of chemical reactions involved in the fused salt extraction of rare earth fission products from LMFR fuel using pound-scale equipment were studied. A series of experiments to determine the solubility of Xe in U–Bi fuel was completed. Additional information on the rate of penetration of Xe and I_2 in graphite was obtained. Specimens of type 347, 430, and 446SS, 16-1 Croloy steel, 1020 mild steel, 1¼ Cr–½ Mo and 2¼ Cr–1 Mo steel, and INOR-8 have completed 1000-hr static exposures to ternary salt, initially containing 5 wt. % $BiCl_3$ at 500°C. The preparation of stable ThO_2–Bi dispersions is in progress. Various corrosion loop operations are reported for the circulation of molten salt systems and to test various structural materials in a molten salt system. A new chemical system containing NO_2, BrF_3, and HF was investigated in the search for a low-temperature, non-aqueous solvent suitable for a generalized fluoride volatility process. Uranium volatility was determined in NO_2–BrF_3–HF solutions, and data are presented. Work was started on the feasibility of using inorganic fluoride solutions to extract Pa^{233} from irradiated ThF_4 blanket material. Laboratory-scale studies on the ignition of natural U in both the liquid and vapor phases of BrF_3 solutions were continued. Further experiments on the hydrochlorination of Zr were made with the fluidized bed reactor. Hot Laboratory Division. The investigation of $Ti^{50}(n,\alpha)Ca^{47}$ was continued, and a study was made of methods of chemical separation of Ti, Sc, and Ca. A new process for the production of Te^{132} was put into operation. Metallurgy. The thermal conductivity measurements on irradiated graphite at the MTR and at Hanford agree very well. Mechanical Engineering. Design of a rotary calciner for handling liquid wastes is nearing completion. Work in connection with the high-level gamma facility is continuing. Design of the shipping casks for the Co strips was completed. (For preceding period see BNL-516.) (W.L.H.)

17050 CEA-869

France. Commissariat à l'Énergie Atomique, Paris.

QUELQUES RÉSULTATS CONCERNANT LA FLUORESCENCE DE GAZ EXCITÉS PAR DES PARTICULES CHARGÉES DE GRANDE ÉNERGIE. (Some Results on the Fluorescence of Gases Excited by High-energy Charged Particles.) L. Koch and R. Lesueur. July 1958. 13p.

The fluorescence induced by high energy charged particles is investigated with argon, krypton, xenon, helium, nitrogen, and a mixture of argon and nitrogen. The results showed that the period of luminescence is very short, usually less than 10^{-8} sec. A linear response is obtained as a function of the energy lost by the particle to the gas, even in the case of strongly ionizing particles such as fission fragments. (J.S.R.)

17051 CF-5225

United Kingdom Atomic Energy Authority. Industrial Group H. Q., Risley, Lancs, England.

GAMMA RAY SHIELDING FOR ENGINEERS. D. G. Andrews. Sept. 1954. 162p. (EMC/P-29; SWP/P-8).

Information is given on the types of particle encountered in nuclear energy plant, their interactions with matter, the calculation of their rates of emission, the acceptable amounts which may be absorbed by the plant operators, and the calculation of radiation level for various source-shield dispositions. (auth)

17052 COO-1018

Illinois. Univ., Urbana. Engineering Experiment Station.

THE AGGLOMERATION OF SOLID AEROSOL PARTICLES. Technical Report No. 16. H. F. Johnstone. Mar. 1, 1959. 64p. Contract AT(11-1)-276. $10.80 (ph), $3.90(mf) OTS.

The variations of size and density of aerosol particles were examined. Experiments were made with a wide variety of substances using a modification of Whytlaw-Gray and Patterson's methods in which free-fall velocity was determined. The mass was estimated both by balancing the gravitational and electrostatic forces and from rising velocities under constant field strength. The results were compared with the shape and structure of the aerosols shown by electron microscopy. The variation of the Stokes' (or drag) diameters was found by combining the results with cascade-impactor and microscope measurements. A modification of the Millikan oil drop apparatus was used. It was concluded that the free-fall velocity of an agglomerate is proportional to the two-thirds power of its mass, and when primary particles are not uniform in size and shape, wide variations in agglomerate densities occur. It was also noted that when primary particles have irregular shapes there is a difference in drag diameter of the agglomerate determined from the rising and falling velocities. This is a factor in electrical precipitation of such aerosols. (J.R.D.)

17053 CU-186

Columbia Univ., New York. Pupin Cyclotron Lab. and Columbia Univ., New York. George B. Pegram Lab.

A DETERMINATION OF THE ABSOLUTE NEUTRON FISSION CROSS SECTION OF U^{235}. George J. Safford and Edward Melkonian. May 1, 1959. 70p. Contract AT-30-1-Gen-72. $2.50(OTS).

The absolute neutron fission cross section of U^{235} at 0.0253 ev has been determined by measuring (σ_t/σ_f) at 5.3 A and combining this with scattering, absorption, and relative fission cross section measurements. Two multiplate ionization chambers, one containing B^{10} and the other U^{235}, were constructed. The flux is determined by making the two chambers as alike as possible and comparing counting rates in the same neutron beam. The amounts of U^{235} and B^{10} in the beam are determined by transmission measurements. After corrections for chamber efficiencies, residual differences between chambers, and incoherent scattering, a value for $(1 + \alpha) = 1.171 \pm 0.009$ at 5.3 A was obtained where $\alpha = (\sigma_{n\gamma}/\sigma_f)$. This leads to a value of 580 ± 7 barns as the absolute fission cross section at 0.0253 ev. These results are independent of the absolute neutron cross section of B^{10}. (auth)

17054 HW-56536

General Electric Co. Hanford Atomic Products Operation, Richland, Wash.

B-PID AND INVENTORY ESTIMATES WITH MINIMUM VARIANCE. K. B. Stewart. July 28, 1958. 26p. Contract AT(45-1)-1350. $4.80(ph), $2.70(mf) OTS.

Methods for estimating the ending material inventory, which has a minimum variance for cases involving one months' and N months' data, are presented. Examples are worked out on simulated and actual situations, and the results are in agreement with the theory. Factors dictating the use of the methods are also discussed. (J.R.D.)

17055 KAPL-1885

Knolls Atomic Power Lab., Schenectady, N. Y.

CUREBO: A GENERALIZED TWO-SPACE-DIMENSIONAL CODING WITH CROSS-SECTION AND DEPLETION CALCULATIONS FOR THE IBM 704. J. A. Archibald, Jr. Apr. 30, 1959. 117p. Contract W-31-109-Eng-52. $2.75(OTS).

The CUREBO code for the IBM 704 is described. The code is divided into three parts including the calculation of nuclear cross sections of the various physical components of a reactor (WOX7), the solution of the multigroup diffusion equations in two-space dimensions in order to find neutron fluxes and sources for an operating reactor containing these components (CURE), and the calculation of fuel and poison depletion as a result of operating this reactor under steady-state conditions (BO2). (auth)

17056 KAPL-1960

Knolls Atomic Power Lab., Schenectady, N. Y.

AN APPROXIMATE CONFIDENCE INTERVAL FOR TWO-SIDED PROPORTION DEFECTIVE IN VARIABLES SAMPLING. Max F. Halperin. July 21, 1958. 12p. Contract W-31-109-Eng-52. $0.75(OTS).

Suppose that the quality of products of a manufacturing process is measured on a continuous scale and that the frequency distribution of quality so measured can be appropriately described by a Gaussian distribution with unknown mean and standard deviation. Suppose quality is considered unsatisfactory when the quality measure is greater than some specified value or less than some other specified value. An approximate procedure at any specified level of confidence is presented for estimating an upper limit to the proportion of unsatisfactory items that the process will produce. The procedure is approximate in the sense that the level of confidence is greater than specified. This work supplements the results available in statistical literature which give exact procedures when quality is considered unsatisfactory only if the quality measure is too large or only if the measure is too small. (auth)

17057 KAPL-M-ELW-8

Knolls Atomic Power Lab., Schenectady, N. Y.

REACTOR KINETICS WITH THE GROUP DIFFUSION MODEL. E. L. Wachspress. May 11, 1959. 29p. Contract W-31-109-Eng-52. $4.80(ph), $2.70(mf) OTS.

A procedure is described for combining the calculation of time-dependent neutron fluxes with thermal analysis. A rather simple forward integration technique used for near critical systems is modified by time-dependent perturbation theory for more reactive systems. A method for calculating flux and adjoint eigenvectors and eigenvalues is described. Spatial flux distributions are based on a generalization of the flux synthesis technique. (auth)

17058 KAPL-M-PHB-1

Knolls Atomic Power Lab., Schenectady, N. Y.

WATER GAP PEAKING. P. Buck and R. J. Roseberry. Mar. 6, 1959. 30p. Contract W-31-109-Eng-52. $4.80(ph), $2.70(mf) OTS.

Experiments conducted in the PMA have investigated the effect on water gap peaking of gap width, flux suppressors, rod extensions, and zoning of burnable poison. Both plane gaps and cross gaps have been studied. The gap widths investigated were 0.200-, 0.400-, and 0.800-inches. To reduce peaking, flux suppressors of cadmium, hafnium, and boron, and rod extensions of zirconium and aluminum were used sepa-

rately and in combinations. The experiments were carried out in an aluminum water-tight box installed in the reactor. Polyethylene was usually used as a moderator, but the aluminum box permitted the use of water for comparison. Structural materials used were aluminum and zirconium. Stainless steel was used to simulate burnable poison. Calculations of the water gap peaking using the IBM-704 CURE code were performed for several of the various core conditions mentioned in order to investigate the accuracy of multigroup calculations in predicting peaking. (auth)

17059 KAPL-M-WBW-7

Knolls Atomic Power Lab., Schenectady, N. Y.
PPA FLUX TRANSIENT STUDY. PART II. DIFFUSION LENGTHS AND GAP PEAKING. W. B. Wright and F. Feiner. May 27, 1959. 18p. Contract W-31-109-Eng-52. $3.30(ph), $2.40(mf) OTS.

The relaxation lengths and peaking of spatial transients arising from hydrogenous gaps are calculated on the basis of a simplified position-dependent spectrum model. These calculations compare favorably with experiment in contrast to position-independent models, namely, WOXX-WANDA and MUFT-SOFOCATE-WANDA. The discrepancies are shown to increase with $\beta\gamma$. (auth)

17060 MSAR-59-52

MSA Research Corp., Callery, Penna.
PROGRESS REPORT NO. 51 FOR FEBRUARY AND MARCH 1959. W. J. Posey, ed. Apr. 15, 1959. 21p. Contract NObs-77023.

Engineering. Studies were continued on film boiling with water inside tubes with heat transfer runs at 2000 and 1200 psia. Subassembly cooling at decay heat power levels is being investigated. Experiments were initiated to investigate the cooling effectiveness of spraying water upon an inductively heated subassembly at decay heat power levels. Pressure buildup in the vapor container during loss of coolant accident is being investigated. A test to evaluate the actual pressure peak and compare it with the theoretical calculated pressure is reported. Chemistry. Fission product release during core meltdown is being investigated. The mode of meltdown and characteristic distribution of released fission products was studied to provide safeguard information for nuclear power plants. The reaction of sodium sulfite and dissolved oxygen in boiler water and feed water is being studied as a function of temperature, oxygen concentration, pH, and Cu^{2+} concentration. (For preceding period see NP-7252.) (W.L.H.)

17061 MSAR-59-67

MSA Research Corp., Callery, Penna.
PROGRESS REPORT NO. 52 FOR APRIL AND MAY 1959. W. J. Posey, ed. June 16, 1959. 38p. Contract NObs-77023.

Engineering: Research pertaining to reactor coolant problems is reported. Included are results from studies of film boiling with water inside tubes, an evaluation of sodium silicate as a chloride stress corrosion inhibitor, studies of subassembly cooling at decay heat power levels, tests on Bettis pressurizer blowdown, and studies of bare austenitic steel corrosion by sea air. Chemistry: The reaction rate of sodium sulfite and dissolved oxygen in boiler and feed water was studied as a function of temperature and ion concentration. (For preceding period see MSAR-59-52). (D.E.B.)

17062 NP-7726

Joint Inst. for Nuclear Research, Dubna, U.S.S.R. Lab. of Theoretical Physics.
APPLICATION OF DISPERSION RELATIONS FOR TESTING QUANTUM ELECTRODYNAMICS AT SMALL DISTANCES. [PART] I. P. S. Isaev and I. S. Zlatev. 1959. 24p.

Dispersion relations for the physical amplitudes in the center-of-mass system have been derived following a method suggested by N. N. Bogolubov for investigating the processes of bremsstrahlung of electrons on a nucleon and pair production by γ quanta on a nucleon in the lowest approximation in "e." (auth)

17063 NP-7742

Harvard Univ., Cambridge, Mass. Cruft Lab.
TABLES OF COULOMB WAVE FUNCTIONS. VOLUME I. (r = 2.0−r = 8.3). Technical Report No. 260. Martin Blume, Norman Briggs, and Harvey Brooks. Apr. 1, 1959. 463p. Contract Nonr-1866(16).

The solutions and the derivatives of the solutions of the differential equation $d^2U^l + \{E + (2/r) - [l(l+1)/r^2]\}\, U^l = 0$ are tabulated. This is the radial part of the hydrogenic wave equation expressed in atomic units. The tables are accurate to seven significant figures. (A.C.)

17064 NYO-2541

New York Univ., New York. Atomic Energy Commission Computing and Applied Mathematics Center.
DIODE-STEERED LINEAR MAGNETIC-CORE MEMORY. A. Melmed and R. Shevlin. May 1, 1959. 23p. Contract AT(30-1)-1480. $4.80(ph), $2.70(mf) OTS.

Techniques which take advantage of word arrangement to make possible large, high-speed magnetic-core memories are described. Economy is obtained by means of a two-coördinate system using diffused junction rectifiers as steering diodes. By taking advantage of the recovery time of these rectifiers, automatic rewrite selection is obtained in a similar sense to that provided by a biased switch core. The functions of sense and inhibit are combined on one winding contributing towards the reduction of the familiar four-wire to a two-wire configuration. Finally, the customary core array geometry is rearranged to facilitate winding each of the two remaining wires as a balanced twisted-pair transmission line to eliminate the post-write disturb signal on the now combined sense/inhibit line. (auth)

17065 ORNL-2670

Oak Ridge National Lab., Tenn.
CAPTURE OF ELECTRONS IN MOLECULAR OXYGEN. G. S. Hurst and T. E. Bortner. July 24, 1959. 124p. Contract W-7405-eng-26. $2.75(OTS).

The low-energy process of electron capture by O_2 was examined with the emphasis on the pressure dependence of the capture cross section at very low energies. O_2 mixtures with Ar, N_2, and C_2H_4 were used in the experiments. The behavior of the attachment coefficient α was observed to be complex, its magnitude depending on the pressures of the two gases in the binary mixture and on the nature of the nonattaching gases. The capture process is illustrated by formulas for the case of oxygen in each gas mixture. Results are tabulated and presented graphically. (J.R.D.)

17066 RDB(S)/TN-2134

Gt. Brit. Springfields Works, Springfields, Lancs, England.
THE THERMAL CONDUCTIVITY OF PACKED AND

POWDERED CALCIUM OXIDE IN AIR. S. Birtwistle and R. A. Shaw. May 27, 1954. 18p.

A method for determining the thermal conductivity of powders is described. The technique was applied to powdered lime and the thermal conductivity found to vary from 0.76×10^{-3} cal/cm sec °C at 100°C to 1.17×10^{-3} cal/cm sec °C at 900°C. The results are considered accurate to ± 6%. (auth)

17067 SCR-81

Sandia Corp., Albuquerque, N. Mex.

CUSHIONING MATERIALS FOR PACKAGING: BIBLIOGRAPHY. Frances Strachwitz, comp. May 1959. 18p. Contract [AT(29-1)-789]. $0.75(OTS).

In this brief bibliography the emphasis is on new cushioning materials for packaging and on environmental testing and performance of these materials. The survey is not intended to be exhaustive. The following sources were consulted: Technical Abstract Bulletin of the Armed Services Technical Information Agency, Sandia Unclassified Documents Catalog, U. S. Government Research Reports, Technical Information Pilot of the Library of Congress, and Engineering Index. (auth)

17068 SCR-96

Sandia Corp., Albuquerque, N. Mex.

ENVIRONMENTAL TESTING TO 2000°F. J. A. Barber. June 1959. 20p. $0.75(OTS).

Presented at Institute of Environmental Engineers, Chicago, Illinois, April 1959.

Some of the apparatus and techniques being used in order to simulate environmental conditions to test supersonic vehicle components are presented. Some specific tests along with plans for future tests are discussed. (W.L.H.)

17069 SCTM-1-59(51)

Sandia Corp., [Albuquerque, N. Mex.].

THE RELATIONSHIP OF THE BINOMIAL PROBABILITY DISTRIBUTION TO OTHER PROBABILITY DISTRIBUTIONS WITH A SELECTED BIBLIOGRAPHY ON THE SUBJECT. D. B. Owen and E. J. Gilbert. June 22, 1959. 24p. Contract [AT(29-1)-789]. $4.80 (ph), $2.70(mf) OTS.

Formulas which connect the binomial probability distribution, the negative binomial probability distribution, the percentage points of the F-distribution, and the incomplete beta probability distribution are given. A bibliography of 54 selected papers on this and closely related subjects is included. (auth)

17070 SCTM-53-59(51)

Sandia Corp., Albuquerque, N. Mex.

UNDERGROUND MINING WITH NUCLEAR EXPLOSIVES. R. E. Smith. May 14, 1959. 32p. Contract [AT(29-1)-789]. $1.00(OTS).

Mining methods have developed in the course of centuries from the breaking of ore by hand from small but rich deposits to modern techniques by which 20,000 to 50,000 tons of low-grade ore can be removed each day from deposits hundreds of feet underground. A further advance in technique is proposed and discussed, namely, the use of nuclear explosives in underground mining. Such a method would add to our national resources by making it possible to mine deposits which cannot now be economically exploited. Proposed nuclear modifications are presented, together with the potentialities and limitations of the proposed technique. (auth)

17071 SCTM-178-59(51)

Sandia Corp., Albuquerque, N. Mex.

A FORMULA FOR DETERMINING SAMPLE SIZE IN HYPERGEOMETRIC SAMPLING WHEN ZERO DEFECTIVES ARE OBSERVED IN THE SAMPLE. D. B. Owen, E. J. Gilbert, G. P. Steck, and D. A. Young. June 3, 1959. 47p. Contract [AT(29-1)-789]. $1.25 (OTS).

Inequalities are derived for determining upper and lower bounds on the sample size which guarantees, with a given confidence, that no more than a given number of defectives will occur in a lot when zero defectives are observed in a sample taken from the lot without replacement. Two extensive tabulations are included, one of $1-(1-\gamma)^{1/k}$, and the other of $\log (1-\gamma)/\log P$. In the first, $\gamma = 0.700, 0.750, 0.800, 0.850, 0.900, 0.950, 0.980, 0.990, 0.995$, and 0.999, and $k = 1(1)500(10)1000(100)11,000$. In the second tabulation, γ and P equal all of the values of γ for the first tabulation, and, in addition, both also equal 0.5000, 0.9750, 0.9995, and 0.9999. These tabulations have applications to the inequality problems, but also to many other problems. (auth)

17072 SCTM-247-56(51)

Sandia Corp., [Albuquerque, N. Mex.].

SUBSURFACE NUCLEAR EXPLOSION FOR SEISMOLOGICAL STUDIES DURING INTERNATIONAL GEOPHYSICAL YEAR. W. R. Perret. July 18, 1956. 19p. Contract [AT(29-1)-789]. $0.75(OTS).

It is proposed that a nuclear device of 60-kt yield be burst underground in the continental United States at a depth of 1 km. Such an explosion will provide a large instantaneous energy source of known magnitude, position, and time of initiation for seismological studies of the interior of the earth. It is suggested that this shot be made as a contribution to the International Geophysical Year, July 1957 to December 1958, and as such be made an open shot. With the exception of close-in diagnostic observations all information concerning the shot would be made generally available. Programs are proposed for close-in measurements of special pertinence to the physics of explosively-loaded earth. (auth)

17073 SCTM-260-55(51)

Sandia Corp., Albuquerque, N. Mex.

TRANSIENT DRAG AND AMERICAN MACHINE FOUNDRY PROJECT MR-1013. B. L. Tucker. Dec. 21, 1955. 9p. Contract [AT(29-1)-789]. $1.80(ph), $1.80(mf) OTS.

American Machine Foundry data of Report MR-1013 are here reinterpreted as indicating (1) that transient drag coefficients of bluff bodies approach steady state 5 or 10 transit times after the shock front strikes the target, and (2) that corner sharpness has much less influence on drag than claimed by MR-1013. (auth)

17074 SUI-59-9

Iowa. State Univ., Iowa City and Minnesota. Univ., Minneapolis.

OBSERVATIONS OF LOW ENERGY SOLAR COSMIC RAYS FROM THE FLARE OF AUGUST 22, 1958. K. A. Anderson, R. Arnoldy, R. Hoffman, L. Peterson, and J. R. Winckler. 49p.

Observations were made of protons at balloon altitudes in the energy range 100 to 300 Mev following a solar sequence of optical flare, r-f noise bursts, and long enduring noise storm. Other particles are shown to have low upper limits to their abundance. The flare particles continue to be observed for at least 2 days and arguments are given to show that their storage and emission takes place in the solar atmosphere. The differential energy spectrum is derived from ionization versus atmospheric depth data and is found to be

E^{-5} dE. Observations by riometer and VHF scatter propagation paths over the polar regions indicate that solar acceleration of protons up to roughly 100 Mev energy is rather frequent. (auth)

17075 UCRL-8687

California. Univ., Berkeley. Lawrence Radiation Lab. EMULSION STATISTICS. Walter H. Barkas. Mar. 12, 1959. 24p. Contract W-7405-eng-48. $0.75(OTS).

Statistical problems presented by the granularity of nuclear track emulsion have been treated. In concentrated emulsions a large fraction of the volume is occupied by solid silver halide crystals of various diameters. This excluded volume makes inapplicable considerations that presuppose the conditions leading to simple distributions. An exact treatment of the elementary track-cell is given. A corrected form of the Jdanov formula is derived. The effect of the emulsion granularity on the energy-loss straggling is calculated. A general formulation of the developability cross section of an emulsion grain is made. The mean primary grain desnity and the grain-density distribution are calculated. The gap-length distribution is derived. It is proved that this is exponential for gaps of all lengths, and that the gap-length coefficient is equal to the true grain density. The effect of secondary ionization is discussed. Parameters have been introduced that can be evaluated experimentally. Knowledge of these quantities will presumably be useful in further resolving the problem of silver halide sensitivity. The statistical methods developed may be useful in other excluded-space problems. (auth)

17076 UCRL-8691

California. Univ., Berkeley. Lawrence Radiation Lab.
COMPLETE DETERMINATION OF POLARIZATION FOR A HIGH-ENERGY DEUTERON BEAM (thesis). Janice Button. May 4, 1959. 126p. Contract W-7405-eng-48. $2.75(OTS).

Measurements were made, by double scattering, of all parameters necessary to describe completely the interaction of the deuteron with complex nuclei. Tensor components of polarization, which characterize the scattering of spin-one particles and which were unobservable at low energies, were determined to be appreciably different from zero. Internal targets at two different positions were used to polarize beams undergoing differing amounts of magnetic bending in the field of the cyclotron in order to separate two polarization components included in the cos ϕ term of the scattering cross section for a polarized beam. Deuterons of 410 and 420 Mev were scattered from beryllium and carbon, respectively. Internal angles of scattering were 10 deg for beryllium and 11 deg for carbon; angles of second scattering extended from 6 to 18 deg. The usual spin polarization (vector polarization) normal to the plane of scattering was found to reach a maximum of about 70%. The impulse approximation was employed to obtain estimates of deuteron cross section and polarization on the basis of nucleon-scattering data. (auth)

17077 WAPD-TM-135

Westinghouse Electric Corp. Bettis Plant, Pittsburgh. P1MG—A ONE-DIMENSIONAL MULTIGROUP P_1 CODE FOR THE IBM-704. H. Bohl, Jr., E. M. Gelbard, G. R. Culpepper, and P. F. Buerger. July 1959. 72p. Contract AT-11-1-GEN-14. $2.00(OTS).

The P_1 multigroup code was written for the IBM-704 in order to determine the accuracy of the few-group diffusion scheme with various imposed conditions and also to provide an alternate computational method when this scheme fails to be sufficiently accurate. The code solves for the spatially dependent multigroup flux, taking into account such nuclear phenomena as slowing down of neutrons resulting from elastic and inelastic scattering, the removal of neutrons resulting from epithermal capture and fission resonances, and the regeneration of fast neutrons resulting from fissioning which may occur in any of as many as 80 fast multigroups or in the one thermal group. The code will accept as input a physical description of the reactor (that is: slab, cylindrical, or spherical geometry, number of points and regions, composition description, group dependent boundary conditions, transverse buckling, and mesh sizes) and a prepared library of nuclear properties of all the isotopes in each composition. The code will produce as output multigroup fluxes, currents, and isotopic slowing-down densities, in addition to pointwise and regionwise few-group macroscopic cross sections. (auth)

17078 WASH-1020

Plesset (E. H.) Associates, Inc., Los Angeles. INDUSTRIAL APPLICABILITY OF LOW LEVEL COUNTING. M. A. Greenfield and R. L. Koontz. June 30, 1959. 59p. Contract AT(49-2)-1372. $1.50 (OTS).

The feasibility of making an accurate and rapid measurement of beta and gamma radiation levels which are comparable with or much less than that of background is demonstrated. Counting at these levels precludes the need for many of the in-plant precautions and attendant expenses which are required for the use of high level radiation. As a consequence, low level counting can extend the range and versatility of radioactive tagging as a means of process control. Criteria are given with which to distinguish between the industrial use of isotopes as contrasted with research or laboratory use. Formulas are developed for evaluating the statistical accuracy of systems that measure radioactivity, and a universal statistical performance curve is given. Analyses are made of the use of very large volumes of scintillation material as well as large volumes of samples for counting very weak sources of gamma rays (less than 10% of natural background) with high efficiency. Performances of various types of detectors are compared on the basis of sample size and detector areas. Tables are presented in terms of the counting times required to achieve a given statistical precision, for beta activities that do not exceed maximum permissible concentrations. Examples are given of problem solving with low level counting. (auth)

17079 WT-1106(Del.)

Stanford Research Inst., Menlo Park, Calif. UNDERGROUND EXPLOSION EFFECTS. D. C. Sachs and L. M. Swift. Mar. 3, 1958. Decl. with deletions June 8, 1959. 113p. Project 1.7 [of] OPERATION TEAPOT. $2.50(OTS).

Measurements were made of surface and subsurface effects of an underground explosion of a 1.2-kt nuclear burst. The measurements included free-field earth and air-blast effects, as well as loading on underground structural devices. From the 76 channels installed on TEAPOT Shot 7, 75 usable records were obtained. The free-field quantities measured include air-blast pressure, earth acceleration, earth stress and strain, and permanent earth displacement. The results are discussed by phenomenon and, in each case, the TEAPOT

data are compared with pretest predictions. Also, where data are available, comparisons are made with previous underground nuclear test results. Some aspects of seismology and soil mechanics as applied to underground explosion phenomena are presented. The most pertinent high explosives results from subsequent tests conducted at the TEAPOT location are summarized. (auth)

17080 AEC-tr-3710

TRANSVERSE OSCILLATIONS OF AN ELECTRON PLASMA IN A CONSTANT MAGNETIC FIELD. G. V. Gordeev. Translated from Zhur. Eksptl'. i Teoret. Fiz. 24, 445-53(1953). 10p. $1.80(ph), $1.80(mf) JCL or LC.

Transverse oscillations of a plasma in a constant magnetic field are considered, and a dispersion equation is derived. With increasing magnetic field it is shown that the frequency of the transverse waves increases, and their damping can increase or decrease. Self excitation of oscillations is possible in strong fields. (auth)

17081 AEC-tr-3731

EQUILIBRIUMS AND REACTIONS IN SYSTEMS WITH A VERY LARGE SPECIFIC SURFACE. (Über Gleichgewichte und Reaktionen in Systemen mit sehr grosser spezifischer Oberfläche.) N. v[on] Raschevsky. Translated for Oak Ridge National Lab. from Z. Physik 53, 107-29(1929). 58p. (Includes original, 23p.). $9.30(ph), $3.60(mf) JCL.

A series of investigations is reported on liquid drop-like systems, whose dimensions are so small that the specific surface has a considerable value and therefore the surface energy and the surface forces should under no circumstances be neglected. The circumstances under which such a microscopic drop will spontaneously divide into two or, more generally, will spontaneously increase its surface was investigated. The examination of the general properties of multi-coherent surfaces with strongly defined surface energy is reported. (W.L.H.)

17082 AEC-tr-3737

ON THE APPEARANCE OF JETS IN CARBON ARCS OF A HIGH CURRENT INTENSITY. [PART] I. R. Wienecke. Translated for Oak Ridge National Lab. from Z. Physik 150, 231-41(1958). 18p. $3.30(ph), $2.40(mf) JCL.

Investigations on the appearance, behavior, and causes of supercontracted column formation in high-current carbon arcs were conducted. The experimental arrangement is discussed, and results are presented graphically. It is noted that as the current increases, from about 500 amps up, the supercontracted column becomes more distinct. Other observations are included, and an interpretation of results is presented. (J.R.D.)

17083 CEA-tr-A-233

LA ROTATION DE PLASMOIDES DANS LE CHAMP MAGNÉTIQUE. (Rotation of Plasmoids in a Magnetic Field.) H. Pupke and H. G. Thom. Translated into French by P. Monnard from Naturwissenschaften 43, 32(1956). 6p.

The rotation of plasmoids in a magnetic field was investigated. The plasmoids were produced in a glass ring filled with neon at 2 mm of pressure. The plasmoids were type II, and in the magnetic field the apparatus was adapted as far as possible to the Stolt arc. For a high anodic voltage of the emitter, only a regular luminescence is observed. The plasmoids appear only with a decrease of voltage. If a unilateral coupling is made, the plasmoids are displaced, according to the magnetic field direction, counter clockwise or in an inverse direction. A further decrease of voltage causes an increase in the displacement speed up to a maximum, then a decrease, and finally a direction change. (J.S.R.)

17084 CEA-tr-A-504

TABLES DE LA PHYSIQUE DES ÉLECTRONS: DE LA PHYSIQUE DES IONS ET DE LA MICROSCOPIE ÉLECTRONIQUE. VOLUME I. C. PHYSIQUE DES IONS. V. DENSITÉS DE COURANT DANS LES ÉMETTEURS D'IONS ET SUR LES SURFACES D'IMPACT (FOYERS). (Tables of Electron Physics, Ion Physics, and Electron Microscope. Volume I. C. Iron Physics. V. Current Densities in the Ion Emitters and on the Impact Surfaces (Focus).) M[anfred]von Ardenne. Translated into French from p.531-61 of Tabellen der Elektronenphysik. Ionenphysik und Übermikroskopie. Band 1, Hauptgebiete, Berlin, 1956. 28p.

Data on current densities in ion emitters and on the impact surfaces are presented in equation, graphic, and tabular form. The characteristics are given for the following: channel emitter tubes; ion sources with high-frequency spark; thermal ion sources; ion sources with ion production by bombardment of metal surfaces with positive ions; ion sources with primary electron collisions; ion sources with Penning discharge; ion sources with magnetically controlled electron oscillation; ion sources with oscillation from high-frequency input; ion sources with incandescent cathode and low voltage gaseous discharge; ion sources with gaseous discharge by incandescent cathode and axial magnetic field and with ion collection in direction of magnetic field; gaseous discharge, incandescent cathode, and axial magnetic field ion sources with ion collection perpendicular to magnetic field; ion sources with incandescent cathode, capillary gaseous discharge, and lateral extraction of ions; "unoplasmatron" ion sources, and "duoplasmatron" ion sources. Measurement of the radiation of ion emitters, practical characteristics of focused beams from ion emitters, geometry of unoplasmatron and duoplasmatron emitter systems, utilization and emission of ions with the duoplasmatron as proton source, ion emissions by small emission apertures, apparatus to vary the proportion of atomic ions in proton sources, hydrogen ion spectra of the duoplasmatron, hydrogen ion spectra of cyclotron ion source as a function of discharge current density, metastable molecular ion beams in proton sources, calculation of the utilization effect for gaseous ion emitters, and calculation of the utilization effect for vapor ion emitters are also considered. (J.S.R.)

17085 NP-tr-238

THE PHYSICAL PROCESSES IN DIFFUSION AND EJECTOR PUMPS. I. THE FLOW PROPERTIES OF THE DRIVING JET AND THE BACKING-VACUUM CRITICAL PRESSURE. Hans-Georg Nöller. Translated by E. Towndrow (U.K.A.E.A., Atomic Energy Research Establishment) from Z. angew. Phys. 7, 218-25 (1955). 36p. $6.30(ph), $3.00(mf) JCL. (Figures omitted; handwritten MS. copy).

The flow properties of the driving jet in a diffusion or ejector pump are examined. The expansion of the driving jet in the mixture chamber is affected in the backing vacuum, but not in the high vacuum, by the intake pressure. It is shown that the increase in pressure in the compression nozzle is caused by a compression shock. These considerations allow for quantitative interpreta-

tions which can be made following the admission of gas on the backing vacuum side. (J.R.D.)

17086 NP-tr-247

ON THE OBSERVATION OF $\pi^0 \rightarrow e^- + e^+ + e^- + e^+$ DECAY. Yu. A. Budagov, S. Victor, V. P. Dzhelepov, P. F. Ermolov, and V. I. Moskalev. Translated from Zhur. Eksptl'. i Teoret. Fiz. 36, 1080-4(1959). 10p.

An event of charge-exchange scattering $\pi^- + p \rightarrow \pi^0 + n$ with subsequent decay $\pi^0 \rightarrow e^- + e^+ + e^- + e^+$ has been observed in scanning the photographs obtained in the hydrogen-filled diffusion cloud chamber placed into magnetic field and exposed to the 160-Mev π-meson beam. One decay of this mode was detected in 2500 events of π^0-meson decays via the usual scheme $\pi^0 \rightarrow 2\gamma$. The estimation of the π^0-meson mass gives the value 141 ± 8 Mev. In the rest system of π^0-meson the opening angles of pairs are equal to 7° and 12°, and the angle between the pair planes does not exceed 37°. The other possible interpretations of the event observed have a very small probability. (auth)

17087 NP-tr-269

THE BEHAVIOUR OF PLASMA IN A RAPIDLY ALTERNATING MAGNETIC FIELD. B. A. Trubnikov. Translated for European Organization for Nuclear Research from p.309-330, Vol. IV, of "Fizika Plazmy," Academy of Sciences, U.S.S.R., 1958. 32p.

This paper was previously abstracted from the original language and appears in NSA, Vol. 13, as abstract No. 689.

17088 NP-tr-271

ON THE MOTION OF A CHARGED PARTICLE IN RAPIDLY ALTERNATING ELECTRO-MAGNETIC FIELDS. A. A. Vedenov and L. I. Rudakov. Translated for European Organization for Nuclear Research from p.42-6, Vol. IV, of "Fizika Plazmy," Academy of Sciences, U.S.S.R., 1958. 9p.

This paper was previously abstracted from the original language and appears in NSA, Vol. 13, as abstract No. 670.

17089 SCL-T-257

VIOLATION OF THE BOGUSLAVSKY-LANGMUIR LAW WHILE HEATING A TUNGSTEN CATHODE BY A HIGH-SURGE PULSE. (Narushenie Zakona Boguslavskovo-Lengmiura pri Nagrevanii Vol'framovovo Katoda Vakuumnoi Lampy Impul'som Toka Bol'shoi Plotnosti.) S. V. Lebedev. Translated by Marcel I. Weinreich (Sandia Corp.) from Zhur. Eksptl.' i Teoret. Fiz. 27, 487-500(1954). 28p. $4.80(ph), $2.70(mf) JCL or LC.

The strength of the anodic current in a tungsten cathode heated by a high-surge current pulse is examined. A description of tests aimed at elucidating the causes of departure from the Boguslavsky-Langmuir law under these conditions is presented. It is concluded that a change in the state of the W under the action of a high-surge current is responsible, not a neutralization of the spatial charge by the ions. (J.R.D.)

17090

THE ACTIVATION OF MOVING DILUTE SUBSTANCES IN A SPACE DEPENDENT NEUTRON FIELD. Walter Hage (Inst. für Elektr. Anlagen und Energiewirtschaft, Aachen) and Rudolf Nicks (Centre d'Etude de l'énergie nucléaire, Mol, Belgium). Atomkernenergie 4, 181-5 (1959) May. (In German)

In many cases it is necessary to know the activity of substances moving with a constant velocity in a neutron field. The number of activated nuclei in a unit volume of a circulating substance in dependence with the space coordinates is calculated. A possible change of density is neglected. Finally, the activity of the substance after the m'th circulation in any neutron field is estimated. (auth)

17091

THERMAL CONDUCTIVITY OF POWDERS. M. J. Laubitz (National Research Council. Ottawa). Can. J. Phys. 37, 798-808(1959) July.

The effective thermal conductivity of several powders of reasonably uniform particle size, and one powder of graded particle size, was measured in the temperature range of 100 to 1000°C. Most of the results can be very satisfactorily explained by assuming that the effective conductivity of the powder is composed of two parts, the first part being a two-phase gas–solid conductivity, and the second an equivalent radiation conductivity. (auth)

17092

THE PROBLEM OF BOUND STATIONARY SHOCK WAVES IN AN IONIZED GAS. Henri Cabannes. Compt. rend. 248, 3527-9(1959) June 22. (In French)

Stationary flows were determined for a gas with infinite electric conductivity, with a shock wave bound at a dihedral point. It was found that the presence of a magnetic field increases the layer and lowers the temperature. (tr-auth)

17093

EFFECT OF THERMAL MOTION ON THE X-RAY REFLECTIVITY OF QUARTZ. D. W. Berreman and TeTse Chang (Univ. of Oregon, Eugene). J. Appl. Phys. 30, 963-6(1959) July.

Two characteristic temperatures for quartz were determined which, when substituted into the Debye-Waller formula and then used to compute the ratios of temperature corrected integrated reflection coefficients of various pairs of sets of Bragg planes, gave results in best agreement with experimentally determined ratios. These temperatures are 508 ± 16°K in the direction of the trigonal axis and 452 ± 15°K in any perpendicular direction. Corresponding values obtained from an approximate formula relating characteristic temperatures with elastic constants were 448 and 398°K, respectively. The fairly good agreement between the characteristic temperatures obtained by the two methods seems to support the conjecture that the modification of the Debye theory used gives a fairly good approximate description of the effect of thermal motion on the x-ray reflectivity of quartz. Calculations based upon the experimentally determined characteristic temperatures indicate that when Bragg spacings are less than about 0.7 A, the reflectivity of quartz at room temperature is reduced to less than half the value that would be obtained if the atoms were rigidly fixed. (auth)

17094

SPECTRUM OF THIN TARGET BREMSSTRAHLUNG BOUNDED BY A FORWARD CIRCULAR CONE. J. H. Hubbell (National Bureau of Standards, Washington, D. C.). J. Appl. Phys. 30, 981-4(1959) July.

The Schiff expression for the cross section per nucleus for thin-target bremsstrahlung into the angular and energy ranges $d\theta_0$ and dk, is integrated analytically over angle from zero to $\bar{\theta}_0$. Results are shown for the case Z = 78, $E_0 - mc^2 = 40$ Mev and $\bar{x} = 0.5$, 1, 2, 4, and 8, where $E_0 - mc^2$ is the kinetic energy of the incoming electron and $\bar{x}$ is the reduced angle $\bar{\theta}_0 E_0/mc^2$. The fraction of the total cross section included in a cone of angle $\bar{\theta}_0$ can be approximated to within 20% by $\bar{x}^2/(1 + \bar{x}^2)$. At $\bar{x} = 1$, or $\bar{\theta}_0 = 0.723°$, the ratio of energy deliv-

ered by photons above $(E_0 - mc^2)/2$ to that below is 9% greater than for the limiting spectral shape at $\bar{\theta}_0 = 0$, or that given by the Schiff expression at $\theta_0 = 0$, and 13% greater than for the spectrum integrated over all angles. For a target of finite thickness, multiple electron scattering should partially suppress the spectral dependence on $\bar{x}$. (auth)

17095

ION DRAG PRESSURE GENERATION. Otmar M. Stuetzer (General Mills, Inc., Minneapolis). J. Appl. Phys. 30, 984-94(1959) July.

A theory of pressure build-up under unipolar ion conduction is presented and verified experimentally. Constriction of the current flow leads to sizeable pressures in insulating liquids. (auth)

17096

SOME CHARACTERISTICS OF A MAGNETICALLY FOCUSED ELECTRON BEAM. George R. Brewer (Hughes (Aircraft Co., Culver City, Calif.). J. Appl. Phys. 30, 1022-38(1959) July.

The detailed behavior of a solid cylindrical electron beam focused by a uniform magnetic field (Brillouin flow) has been studied experimentally. These studies include the influence of the optics of the electron gun on the beam-focusing characteristics, the effects of transverse "thermal" velocities, the change in the internal beam dynamics with increasing values of magnetic focusing field, etc. A simple model of the beam is used to explain certain of the observed characteristics. It is found that an optically good electron gun will produce a focused beam which closely resembles the theoretical Brillouin-flow model. A brief analysis of the electron motion in a magnetically focused beam is given in the Appendix. (auth)

17097

ABSORPTION OF RADIATION BY A CYLINDRICAL SAMPLE OF A STRONG ABSORBER. P. H. Fang and Irene A. Stegun (National Bureau of Standards, Washington, D. C.). J. Chem. Phys. 31, 267(1959) July.

A discussion is given of an integral which occurred in the theoretical calculation of the rate of energy absorption. This integral, in the notation of W. H. Clingman, is compared to a Bessel function. (C.J.G.)

17098

MULTIPLE IONIZATION OF SODIUM VAPOR BY ELECTRON IMPACT. Vernon H. Dibeler and Robert M. Reese (National Bureau of Standards, Washington, D.C.). J. Chem. Phys. 31, 282-3(1959) July.

Typical ionization probability curves for the Na^+, Na^{2+}, and Na^{3+} ions are plotted, respectively, as the first power, the square root, and the cube root of the ion currents versus the electron energy for electron energies up to 200 v. (C.J.G.)

17099

GAMMA-RAY BURST FROM A SOLAR FLARE. L. E. Peterson and J. R. Winckler (Univ. of Minnesota, Minneapolis). J. Geophys. Research 64, 697-707(1959) July.

A burst of high-energy radiation coincident with a solar flare has been detected during a balloon flight at 10 g/cm^2 atmosphere depth and 30° geomagnetic latitude over Cuba. The flare occurred at 1305 UT on March 20, 1958, and was associated with solar radio bursts on 1,500 and 10,000 Mc/s. Terrestrial effects included a SID, earth-current disturbances, and a magnetic crotchet. The 18-second burst was detected with an integrating ionization chamber and a single Geiger counter. From these two instruments and their ratio, it is inferred that the radiation is due to a gamma-ray flux of about 2×10^{-5} ergs/sec cm^2 peaked in the 200- to 500-kv region. This radiation can be interpreted as bremsstrahlung produced in the solar photosphere from electrons of 0.5 to 1 Mev energy. These same electrons, spiraling in a 1000-gauss field in the flare region, can produce the observed radio burst by betatron radiation. The high-energy electrons represent about 1 per cent of the flare energy. Only about 0.01 per cent of the emitted betatron radiation escaped from the flare region toward the earth. (auth)

17100

IONIZING RADIATION AT ALTITUDES OF 3,500 TO 36,000 KILOMETERS. PIONEER I. Alan Rosen, Charles P. Sonett, and Paul J. Coleman, Jr. (Space Technology Lab., Inc., Los Angeles) and Carl E. McIlwain (State Univ. of Iowa, Iowa City). J. Geophys. Research 64, 709-12(1959) July.

The total ionizing component of cosmic radiation was measured on October 11, 1958, by means of an ionization chamber mounted on the Pioneer I lunar probe vehicle. Data were taken over an altitude range of 3,500 to 26,000 km and a latitude range of 35°N to 5°N. The calibration procedure and the analysis of the telemetered data are described. (auth)

17101

EFFECT OF MAGNETIC ANOMALY ON PARTICLE RADIATION TRAPPED IN GEOMAGNETIC FIELD. A. J. Dessler (Lockheed Aircraft Corp., Palo Alto, Calif.). J. Geophys. Research 64, 713-15(1959) July.

Anomalies in the geomagnetic field will affect the mirror altitude of trapped particles. A negative magnetic anomaly (abnormally weak magnetic field strength) will lower the mirror altitude of the trapped particles which are reflected near the anomaly. The large negative anomaly near Capetown, South Africa, will lower the local mirror altitude by about 1000 km. Since the trapped particles drift around the earth's magnetic axis, the outward projecting 'horns' in the contours of constant radiation intensity as revealed by Satellite 1958 ϵ may be explained on the basis of this anomaly and the east-west drift of the trapped particles. The gap in the radiation belt as revealed by Lunar Probe Pioneer III is also apparently related to this anomaly, and the intensity at the minimum relative to the adjoining maxima indicates that most of the trapped particles are reflected at relatively low altitudes. (auth)

17102

GEOMAGNETIC DISTURBANCES DUE TO NUCLEAR EXPLOSION. Hiroshi Maeda (Kyoto Univ.). J. Geophys. Research 64, 863-4(1959) July.

Magnetograms from Honolulu Observatory indicate that nuclear explosions had effects on geomagnetic variation on August 1 and 12, 1958. (C.J.G.)

17103

A TECHNIQUE FOR THERMAL-SHOCK AND THERMAL-FATIGUE TESTING BASED ON THE USE OF FLUIDIZED SOLIDS. E. Glenny, J. E. Northwood, and T. A. Taylor (National Gas Turbine Establishment, Farnborough, Hants, Eng.) and S. W. K. Shaw (The Mond Nickel Co., Ltd., Eng.). J. Inst. Metals 87, 294-302(1959) May.

A description is given of the development of a laboratory test for studying the behavior of materials under conditions of transient thermal stress, such as may be

encountered by the turbine blading of a gas-turbine engine. The requirements of such a test are considered, and a number of possible methods of heating and cooling are reviewed. It is concluded that the most suitable laboratory testing technique is by immersion of the test specimen in a bed of powdered refractory substance supported on a permeable plate and fluidized by a stream of air. Fluidized beds are suitable for rapid heating as well as for rapid cooling experiments. The equipment for carrying out such tests, either separately or in combination, is fully described. The apparatus is simple to use, and is trouble-free in operation. The test conditions are uniform and reproducible and can be accurately controlled. (auth)

17104

STUDY OF THE COOLING OF A GAS OF CHARGED PARTICLES IN A COMPLETELY IONIZED PLASMA. A. Brin and J. Salmon (Commissariat à l'Énergie Atomique, Paris) and J.-L. Delcroix (École Normale Superieure, Paris). J. phys. radium 20, 529-34(1959) May. (In French)

The cooling of a gas of charged particles in a fully ionized plasma is studied according to the hypotheses of Rosenbluth, MacDonald, and Judd. The gas concentration is assumed low compared with the concentration of plasma particles. In these conditions the process obeys a partial differential equation. This equation is linear. The method of eigen functions and values is applicable, and it is possible to define relaxation times. In a particularly important case, the characteristic deviations and relaxation times can be obtained in detail. A comparison is made with the results of Spitzer. (auth)

17105

TEST ON THE TOTAL ATMOSPHERIC RADIATION AT HIGH ALTITUDE. Jacques Labeyrie (Centre d'Études Nucleaires, Saclay, France) and Henri Le Boiteux (Office National d'Études et de Recherches Aeronautiques). J. phys. radium 20, 574-5(1959) May. (In French)

A group of Geiger counters was mounted in an experimental missile head in order to study the behavior of the detectors and the associated electronic equipment at rocket accelerations and to determine the direct atmospheric radiation as a function of altitude. The mounting of the counters is described in detail. The rocket was launched on Jan. 27, 1959, at a latitude of 43°N. The counter pulses were recorded on the ground up to a rocket altitude of 65 km. The counting rate is graphed as a function of the altitude. A maximum count of 15.6 pulses/sec was obtained, and a counting plateau was reached at 45 km. The apparatus performed well. (J.S.R.)

17106

QUENCHING EFFECT OF THE PHOTOCONDUCTIVITY DECAY IN CdS. Makoto Kikuchi and Sigeru Iizima (Electrotechnical Lab., Tokyo). J. Phys. Soc. Japan 14, 856(1959) June.

The quenching effect of photoconductivity decay of a flaky CdS crystal having one face of evaporated In and the opposite face Ag paste is described. (C.J.G.)

17107

LUMINESCENCE OF KI:Tl INDUCED BY FAR ULTRAVIOLET LIGHT. Masayasu Ueta and Takehiko Ishii (Univ. of Tohoku, Sendai, Japan). J. Phys. Soc. Japan 14, 857-8(1959) June.

A description of the quantum yield of Tl fluorescence in KI crystals irradiated with ultraviolet light is given. (C.J.G.)

17108

AN EXPERIMENTAL STUDY OF THE LINEAR PINCH STABILITY. Tage Sundström and Sven Svennerstedt (Inst. of Physics, Uppsala). Nuclear Inst. & Methods 4, 213-20(1959) May.

The time to the first bounce of the dynamic pinch has been measured and compared with the formula derived by Rosenbluth. The theoretical dependence on gas pressure and electric field strength is verified. A coil system is described which has been used to detect kink instabilities. When an axial magnetic field of sufficient strength has been applied, it has become impossible to detect the kink instabilities which are shown to destroy the pinch in zero and moderate magnetic fields. Stability observations have been carried over several periods of the discharge. This revealed that the plasma performs a contraction and seems to be stable in the subsequent periods also. Finally, an investigation has been made of the pressure dependence of the electro-mechanical oscillation which is performed by the plasma sheath before reaching equilibrium where the axial and azimuthal magnetic fields balance. (auth)

17109

MEASUREMENT OF SURFACE DENSITY OF THIN FOILS. K. Ramavataram and D. I. Porat (University, Manchester, Eng.). Nuclear Instr. & Methods 4, 239-42(1959) May.

A Po^{210} alpha source is used to measure the surface density of thin foils with a resolution of approximately 1 $\mu g/cm^2$. A calibration procedure is described to convert air equivalents to units of surface density. The mass stopping power of Al, Ni, Ag, and Au relative to air at an alpha energy of 3.72 and 4.33 Mev is reported. (auth)

17110

LANDAU'S MODEL OF LIQUID He^3. Tunemaru Usui (Argonne National Lab., Lemont, Ill.). Phys. Rev. 114, 21-6(1959) Apr. 1.

Landau's model of liquid He^3 as a Fermi liquid is studied with regard to its lowest temperature properties. Primary stress is laid on the coefficient of thermal expansion. The spectra used by Abrikosov and Khalatnikov, the perfect-gas type and "bubble" type, are shown to give a positive coefficient of thermal expansion, in contradiction with experiment. An alternative simple spectrum is suggested which can give a negative coefficient of thermal expansion, namely $\Delta + p^2/2m^*$. In addition, the existence of a negative coefficient of thermal expansion is shown to imply a strong temperature dependence of the energy spectrum, which may cause a sharp deviation of the heat capacity curve from the perfect-gas type, similar to the deviations observed in liquid He^3. (auth)

17111

STARK EFFECT FOR CYCLOTRON RESONANCE IN DEGENERATE BANDS. J. C. Hensel and Martin Peter (Bell Telephone Labs., Murray Hill, N. J.). Phys. Rev. 114, 411-17(1959) Apr. 15.

A calculation of the motion is given for an electron in a simple band subjected to perpendicular magnetic and electric fields. It is shown that the cyclotron resonance frequency is unaffected by the presence of the electric field. For degenerate bands, however, there is a Stark shift of the cyclotron transitions between the low-lying "quantum" states. Calculations using second-order perturbation theory indicate that fractional line shifts of $\Delta\nu/\nu_0 \sim 10\%$ may be obtained under reasonable ex-

perimental conditions. This effect may be useful in the study of the valence bands of germanium and silicon. (auth)

17112

THERMAL RESISTANCE DUE TO ISOTOPES AT HIGH TEMPERATURES. V. Ambegaokar (Westinghouse Research Labs., Pittsburgh). Phys. Rev. 114, 488-9 (1959) Apr. 15.

In pure dielectric crystals, the isotopic variations of atomic mass contribute a temperature-independent thermal resistance at high temperatures. This resistance has been calculated using a Debye model of the vibrational spectrum. Umklapp processes are treated as the dominant scattering mechanism. The distribution of the heat current over the vibrational modes is known for low frequencies. This distribution is considered to apply over the whole frequency spectrum. The calculated result is compared with the experiments of Geballe and Hull on isotopically pure germanium. A satisfactory agreement with experiment is obtained. (auth)

17113

ZEEMAN INVESTIGATIONS OF CURIUM-242. J. C. Hubbs, R. Marrus, and J. O. Winocur (Univ. of California, Berkeley). Phys. Rev. 114, 586-9(1959) Apr. 15.

The atomic-beam magnetic-resonance method has been used to investigate 163-day Cm^{242}. The spin of this even-even nuclide is found to be zero. Four low-lying electronic energy levels are found, and the Lande g-factors are measured to be $g_{J2} = 2.561 \pm 0.003$, $g_{J3} = 2.000 \pm 0.003$, $g_{J4} = 1.776 \pm 0.002$, and $g_{J5} = 1.671 \pm 0.003$. No direct measurement can be made of the angular momenta of these levels, but other considerations contained in the text make highly probable the J values indicated in subscripts and arising from the electronic configuration $(5f)^7\ (6d)^1\ (7s)^2$. (auth)

17114

HEAT CAPACITY OF ALUMINUM BETWEEN 0.1°K AND 4.0°K. Norman E. Phillips (Univ. of California, Berkeley). Phys. Rev. 114, 676-85(1959) May 1.

Measurements of the heat capacity of aluminum have been made between 0.11 and 4.0°K in the normal state and between 0.17 and 4.0°K in the superconducting state. Within the experimental error the normal state heat capacity, C_n, can be represented by $C_n = \gamma T + \beta T^3$ with $\gamma = 1.35 \times 10^{-3}$ Joules/mole deg^2 and a value of β corresponding to a Debye temperature of 427.7° in agreement with calculations based on elastic constants. For reduced temperatures between 0.5 and 0.25 the electronic heat capacity in the superconducting state, C_{es}, is approximated by $C_{es}/\gamma T_c = 7.1 \exp(-1.34\ T_c/T)$, in which T_c is the transition temperature, 1.163°K. At reduced temperatures less than about 0.25, C_{es} is greater than an extrapolation of the exponential, the difference amounting to a factor of 4 at the lowest temperature. The departure of C_{es} from an exponential temperature dependence, which is believed to be outside the experimental error, is not consistent with the existence of a constant energy gap at low reduced temperatures. The calculated critical field is 103.0 gauss at 0°K and shows a maximum negative deviation of 4% from the parabolic law. The results are compared with other measurements and with theory. (auth)

17115

DIFFUSION OF RUTHENIUM IN SINGLE CRYSTALS OF SILVER. C. B. Pierce and D. Lazarus (Univ. of Illinois, Urbana). Phys. Rev. 114, 686-7(1959) May 1.

The diffusion coefficient of ruthenium in monocrystalline silver has been measured over the temperature range 793 to 945°C, using Ru^{103} and Ru^{106} tracers, and a sectioning technique. The results may be expressed by an Arrhenius relation as $D = (180 \pm 70) \exp[-(65{,}800 \pm 1000)/RT]$ cm^2/sec. The present result is consistent with earlier theoretical models, unlike the results obtained by Mackliet for Fe in Cu. (auth)

17116

CHARGE DISTRIBUTION AND RANGE EFFECTS PRODUCED BY 3-Mev ELECTRONS IN PLEXIGLAS AND ALUMINUM. Bernhard Gross and Kenneth A. Wright (Massachusetts Inst. of Tech., Cambridge). Phys. Rev. 114, 725-7(1959) May 1.

Charge distribution curves of nearly parallel beams of monoenergetic electrons of 3 Mev have been measured in Plexiglas and aluminum. The charge distribution in depth reaches a maximum at approximately $^2/_3$ of maximum range. The maximum in Plexiglas is sharper than in aluminum. The results confirm the existence of a space charge layer in dielectrics after electron bombardment. The measured charge distribution reflects the differential range distribution of monoenergetic electrons. (auth)

17117

MEASUREMENT OF THE MOTT ASYMMETRY IN DOUBLE SCATTERING OF ELECTRONS. D. F. Nelson and R. W. Pidd (Univ. of Michigan, Ann Arbor). Phys. Rev. 114, 728-35(1959) May 1.

The Mott asymmetry was observed at 121 kev for gold targets and scattering angles of $\theta_1 = 90°$ and $\theta_2 = 80$ to 140°. The cosine dependence of the asymmetry on the azimuthal angle was shown in all cases. A weak magnetic lens (maximum field: 12.5 gauss) was used between the two scatterers, and a low-resolution (8%) electrostatic energy analyzer was used after second scattering. The measured asymmetry amplitudes are compared with the calculations of Sherman (pure Coulomb field) and of Mohr and Tassie (screened Coulomb field). The experimental values for $\theta_2 = 90$, 100, and 110° agree well with either theoretical curve but are not accurate enough to distinguish between them. The measured value at $\theta_2 = 80°$ is enough higher (17%) than the pure Coulomb field curve to indicate a screening effect. The experimental values for $\theta_2 = 120$, 130, and 140° fall from 15 to 20% below the theoretical curves. This discrepancy is attributed to plural scattering. Measurements made using the magnetic lens but not the energy analyzer yield asymmetries reduced in amplitude about 33% and shifted in phase by 26° when compared with the measurements discussed above. This is believed due to the presence of an appreciable number of polarized electrons at a considerably lower energy than 121 kev in the first scattered beam. (auth)

17118

COHERENT ATOMIC SCATTERING FACTORS FOR THE LITHIUM HYDRIDE CRYSTAL FIELD. R. P. Hurst (Univ. of Wisconsin Naval Research Lab., Madison). Phys. Rev. 114, 746-51(1959) May 1.

An effort made to evaluate the coherent atomic scattering factors for the lithium and hydride ions as they exist in the LiH crystal field is described. The two electron wave functions chosen to describe these ions are each in turn optimized in the field of positive and negative point charges arranged as the corresponding ions are arranged in the crystal. Using the orbital exponents obtained from the minimization process, atomic scattering factor calculations are made in the usual

way. The factors for Li^+ are unchanged. Interesting effects are noted for the H^- scattering factors. The energy of the ions in the field of point charges is related to the crystal cohesive energy. Specifically, neglecting the zero-point energy correction, the calculated open configuration results were −236.3 and −227.4 kcal/mole when compared with computed and experimentally determined free H^- reference energies, respectively. The experimental cohesive energy is −218.5 kcal/mole. Finally, it was noted that the H^- ion contracts in the crystal field. A possible explanation for this effect is given. (auth)

17119

SUPERCONDUCTIVITY VERSUS FERROMAGNETISM IN LANTHANUM–GADOLINIUM ALLOYS. R. A. Hein and R. L. Falge, Jr. (Naval Research Lab., Washington, D. C.) and B. T. Matthias and C. Corenzwit (Bell Telephone Labs., Murray Hill, N. J.). Phys. Rev. Letters 2, 500-2(1959) June 15.

The differential paramagnetic susceptibility of samples of La–Gd alloys containing from 0.6 to 5.00% Gd was measured in the temperature range from 4.22 to 0.10°K. Matthias et al. have shown that the addition of small amounts of Gd to La produced solid solutions with unusual magnetic properties. Alloys containing up to 0.90% Gd are superconductors with transition temperatures (T_c) which decrease linearly with increasing Gd content. Alloys containing 3.0% or more Gd are ferromagnetic with Curie temperatures which increase with increasing Gd content. The alloy containing 3.0% Gd becomes ferromagnetic at 1.3°K, the lowest temperature attained. Extrapolation of the data suggests that the T_c vs. % Gd curve and the Curie temperature vs. % Gd curve would intersect for an alloy of 1.25% at a temperature of 0.5°K. (A.C.)

17120

CALCULATION OF PARTITION FUNCTIONS. J. Hubbard (Univ. of California, Berkeley). Phys. Rev. Letters 3, 77-8(1959) July 15.

The manner in which a transformation due to Stratonovich can be used to calculate approximately the grand partition functions of some many-body systems is described. (A.C.)

17121

SCATTERING OF 50- TO 140-Mev PHOTONS BY PROTONS AND DEUTERONS. L. G. Hyman, R. Ely, D. H. Frisch, and M. A. Wahlig (Massachusetts Inst. of Tech., Cambridge). Phys. Rev. Letters 3, 93-6(1959) July 15.

Further work below the meson threshold using both protons and deuterons as targets is reported. Experimental and theoretical cross sections for scattering of photons by hydrogen are plotted as a function of lab energy at a c.m. angle of 90°. The conclusions are: (1) the observed scattering of photons by protons at 90° c.m. over the energy range 0 to 300 Mev is described well by a model of the proton as a Dirac particle plus strong pion interactions giving the well-known $\frac{3}{2}$, $\frac{3}{2}^+$ and $\frac{1}{2}$, $\frac{3}{2}-$ resonances, provided the half life of the π^0 meson is greater than 10^{-18} second; (2) the scattering of photons by deuterons below meson threshold is more than expected. (A.C.)

17122

ON HIGH ENERGY POTENTIAL SCATTERING. L. M. Garrido and A. Galindo Tixaire (Junta de Energía Nuclear, Madrid). Physica 25, 473-5(1959) June.

The use of the effective Green function made by Malenka for small scattering angle to any angle, introducing the initial and final effective Green functions is generalized. Starting from the result of Khalatnikov, Saxon, and Schiff's formulas and new error estimates are obtained. (auth)

17123

ABUNDANCES OF EVEN-MASS ISOBARS. A. H. W. Aten, Jr. (Instituut voor Kernphysisch Onderzoek, Amsterdam). Physica 25, 503-8(1959) June.

The sum of the abundances of two isobars, which both have an appreciable abundance, is generally less than what it should be to agree with the interpolated value of other normal abundances. (auth)

17124

ELECTRICAL OSCILLATIONS IN A D.C. GLOW DISCHARGE. V. T. Chiplonkar and J. Mangaly (Inst. of Science, Bombay). Proc. Indian Acad. Sci., Sec A 49, 262-3(1959) May.

The phenomenon of electrical oscillations in the case of a d-c discharge in hydrogen in the region of the positive v-i characteristic has been investigated for the pressure range 40 to 200 microns, discharge voltages 0.6 to 11.2 kv, and discharge currents 0.1 to 2.5 ma. Coherent oscillations were observed in the frequency range 40 to 100 kc/sec which were accompanied by three or four frequency groups in the range 170 to 2,300 kc/sec. The existence of a common cut-off current for all these frequencies has been shown which is found to depend on the pressure in such a manner that it has a maximum value for p = 60 to 90 microns. The frequencies of the oscillations show a significant dependence on i and p and are independent of the circuit parameters. The frequencies have a minimum value for p = 60 to 90 microns. The lower frequencies show only an insignificant variation with i whereas in the highest frequency group there is a very rapid rise of frequency with current. The amplitude of the oscillations is determined by i and p and shows a maximum for some value of i and p = 60 to 90 microns. The variation of the amplitude in the different regions of the discharge indicate that the seat of the oscillations is in the negative glow. The processes in the cathode dark space have been shown to have a significant effect on the electrical oscillations. (auth)

17125

SELF-ABSORPTION IN AN ELECTRODELESS DISCHARGE IN HYDROGEN AND HELIUM. J. A. Harrison (Univ. of Liverpool). Proc. Phys. Soc. (London) 73, 841-8(1959) June.

A simple and direct way of measuring self-absorption in a 24 Mc/s discharge is described. The results obtained with hydrogen and helium at pressures between 12 microns and 1.6 mm of Hg are used to determine absorption coefficients and excited level populations. Under the conditions described, self-absorption of H_α and H_β must be taken into account when measuring line intensities. (auth)

17126

THE SCATTERING OF FAST CHARGED PARTICLES. IV. ON THE MEASUREMENT OF THE DETOUR FACTOR FOR 10 Mev ELECTRONS AND POSITRONS. K. Phillips (Metropolitan-Vickers Electrical Co., Manchester, Eng.). Proc. Phys. Soc. (London) 73, 953-6 (1959) June.

The path length-foil thickness ratio of absorbers is called the detour factor. A method of measuring the detour factor in G5 nuclear emulsions for 10-Mev elec-

trons and positrons is described, and the results are compared with theory. (L.T.W.)

17127

A MEASUREMENT OF THE SPIN CORRELATION COEFFICIENT C_{kp} IN p-p SCATTERING AT 382 Mev, FOR 90° CENTRE-OF-MASS SCATTERING ANGLE. A. Ashmore, A. N. Diddens, and G. B. Huxtable (Univ. of Liverpool). Proc. Phys. Soc. (London) 73, 957-9(1959) June.

The coefficient C_{kp} is a measure of the correlation between spin components of the two protons in the scattering plane. The correlation coefficient was measured by means of a second scattering of both protons from carbon, with analysis in coincidence. (L.T.W.)

17128

THE GROWTH OF LONGITUDINAL WAVES PROPAGATING IN PLASMA. G. F. Filimonov. Radiotekh. i Elektron. 4, 75-87(1959).

An attempt is made to find a solution of the Vlasov equation which would permit the determination of the direction of the plasma perturbations transported by each eigenwave. In the analysis it is assumed that the plasma is infinite and the motion of the particles is one dimensional. (J.S.R.)

17129

PRIMENENIYE RADIOAKTIVNYKH IZOTOPOV V TEKHNIKE. (Use of Radioactive Isotopes in Engineering.) Petr Yefimovich D'yachenko. Moscow, Mashgiz, 1958. 214p.

The use of radioisotopes in engineering laboratory research and in industrial plant processes is discussed. The book is intended for engineering and technical personnel at plants and institutes. The problem of wear of machine parts and the mechanism of wear as studied by radioisotopes are considered in detail. The methods and equipment used for thickness measurements and metal defectoscopy are described. Radiation effects on metals are also considered. (J.S.R.)

17130

MAX-PLANCK-FESTSCHRIFT, 1958. (Max Planck Anniversary Publication, 1958.) B. Kockel, W. Macke, A. Papapetrou, and W. Frank, eds. Berlin, Veb Deutscher Verlag der Wissenschaften, 1959. 413p.

The hundredth birthday of Max Planck is honored by the publication of works on the problems of contemporary physics. The contributions are divided into three groups, dealing with classical, relativistic, and quantum physics. Separate abstracts of the contributions have been prepared. (J.S.R.)

17131

THE ELECTROLYTIC WORKS OF MAX PLANCK AND THEIR FURTHER DEVELOPMENT. H. Falkenhagen (Universität, Rostock, Ger.). p.11-34 of "Max-Planck-Festschrift, 1958." (In German)

A discussion of the classical works on the electrolyte theory of ideal dilute solutions by Arrhenius and Planck serves as an introduction to the present developments in the field. The construction of clear model conceptions and the application of rigid statistics has led to the formulation of a large number of limiting laws for solutions of strong electrolytes and has permitted the study of the properties of concentrated solutions. Recent works in this field were especially considered. 41 references. (tr-auth)

17132

CONTINUED DEVELOPMENT OF THE KIRCHOFF DIFFRACTION THEORY TO A STRICT THEORY. H. Hönl and K. Westpfahl (Albert-Ludwigs-Universität, Freiburg i. B.). p.35-64 of "Max-Planck-Festschrift, 1958." (In German)

Diffraction theory was developed basically as a boundary value problem of mathematical physics, in opposition to the Kirchhoff statement. The diffraction or scattering field is then a result of the oscillating surface current which flows on the surface of the (ideally conducting) diffracting obstruction; its distribution was generally determined by integral equations. These integral equations were transposed by wave screening by the Fourier method into dual singular integral equations which are rigidly solved for the half wave and solved by asymptotic development for the slit. A new simple method is thus obtained for the treatment of these problems which leads, especially in the slit problem, to a development by decreasing powers of $2\pi a/\lambda$ (a is the slit width and λ the wavelength). 20 references. (tr-auth)

17133

CLEAR REPRESENTATION OF ELECTRIC QUADRUPOLE AND MAGNETIC DIPOLE RADIATION. A. Rubinowicz (Polish Academy of Sciences, Warsaw). p.65-82 of "Max-Planck-Festschrift, 1958." (In German)

A second equally large, but antiparallel, dipole is opposed by a displacement given by the vector $\vec{\beta}$ to a linear electric dipole which is diffused by the current J(t) and is represented by the vector $\vec{\alpha}$. Such a current system emits an electric quadrupole and a magnetic dipole radiation. The magnetic dipole radiation caused corresponds to a magnetic dipole moment which is perpendicular to the plane of the vectors $\vec{\alpha}$ and $\vec{\beta}$. It is equal to the dipole moment of a current loop diffused by the current $\frac{1}{2}J(t)$. The current loop has the configuration of the sides of the parallelogram described by the vectors $\vec{\alpha}$ and $\vec{\beta}$. The electric quadrupole radiation is determined by a degenerate symmetrical tensor T_S. One of its principal axes is parallel to the magnetic dipole and belongs also to a disappearing eigenvalue of the tensor T_S. The directions of both other principle axes are given by both angle bisectors of the directions of both vectors $\vec{\alpha}$ and $\vec{\beta}$. The absolute sums of their corresponding eigenvalues are equal to the squares of the diagonals of a rhombus with the side lengths $\frac{1}{2}(\alpha,\beta)^{\frac{1}{2}}$, which extends in the direction of both vectors. The representation of the "spherical harmonic quadrupole" which indicates the electromagnetic radiation of the single Zeeman component of an electric quadrupole line, is given by the "opposition quadrupole" considered earlier. (tr-auth)

17134

MOMENTUM SPECTRUM OF COSMIC RADIATION. H. Alfvén (Royal Inst. of Tech., Stockholm). p.83-96 of "Max-Planck-Festschrift, 1958."

If, in a variable magnetic field, charged high-energy particles are injected at a certain point, they are accelerated, but at the same time they diffuse outwards from the point of injection. Near the point of injection the density in a volume element of six-dimensional phase-space is increased by the acceleration process but decreased by the diffusion, and the momentum spectrum is obtained from the stationary state when these two effects are equal. The theory gives the power spectrum in which the value of the exponent depends in a

very insensitive way on the rate of acceleration and the rate of diffusion. The spectrum depends on the distance from the source of injection and the average energy density is orders of magnitude smaller than the density near the source of injection. The theory is in agreement with the "local" theory of cosmic radiation, but it is difficult to reconcile it with galactic or extragalactic theories. (auth)

17135

THE CONSTELLATION PERSEUS I. V. G. Ambarzumyan (Ambarzumjan) (Byurakan Observatory, Armenian Academy of Sciences). p.97-102 of "Max-Planck-Festschrift, 1958." (In German)

From the analysis of the peculiarities which the constellation Perseus I exhibits, whose age is approximately 15×10^6 years, it is shown that the process of star origin in this constellation is proceeding even today. This result is in contradiction to the hypothesis that the stars of constellations arise from diffuse matter. A considerably higher age is obtained for the stars of some spectral classes of this constellation from kinematic considerations than from energy considerations. The possibility of explaining these differences by the occurrence of a fixed latent state in the life of a future super giant whose luminosity is very low is discussed. (tr-auth)

17136

THE THERMODYNAMICS OF THERMAL INSTABILITY IN LIQUIDS. S. Chandrasekhar (Univ. of Chicago). p.103-14 of "Max-Planck-Festschrift, 1958."

The thermodynamics of thermal instability in liquids is considered, and the following theorem is proved: thermal instability as cellular convection will set in at the minimum (adverse) temperature gradient which is necessary to maintain a balance between the rate of dissipation of energy by all irreversible processes present and the rate of liberation of the thermodynamically available energy by the buoyancy force acting on the fluid. Likewise, the onset of thermal instability will occur as overstable oscillations if it is possible (at a lower adverse temperature gradient) to balance in a synchronous manner the periodically varying amounts of kinetic and other forms of energy with similarly varying rates of dissipation and liberation of energy. (auth)

17137

ON VARIATIONAL PRINCIPLES IN RELATIVISTIC DYNAMICS. L. Infeld (Univ. of Warsaw). p.115-27 of "Max-Planck-Festschrift, 1958."

Variational relativistic principles, that is, essentially the Lagrangian, in the mechanics of point particles are considered. The case of velocity smaller than that of light and the case of velocity equal to that of light are investigated. Only for the first case are the relativistic Hamiltonian and Jacobi's equation considered. (auth)

17138

ON THE RELATIVISTIC GASES. M. Sasaki (Tokyo Metropolitan Univ.). p.129-38 of "Max-Planck-Festschrift, 1958."

A survey of the development of relativistic hydrodynamics and gas kinetics since the fundamental work of Planck on this subject is given. Then Synge's method of treatment of perfect gases is briefly dealt with. This method is extended to the treatment of the nonstationary state, and expressions for viscosity and heat conductivity of relativistic gases are derived. (auth)

17139

THE ENERGY OF NON-CLOSED SYSTEMS IN THE GENERAL RELATIVITY THEORY. C. Möller (Universitetets Institut for Teoretisk Fysik, Copenhagen and NORDITA, Copenhagen). p.139-53 of "Max-Planck-Festschrift, 1958." (In German)

With a suitable definition of the energy-pulse pseudovector density, an expression, invariant with respect to spatial transformations, can be obtained for the energy discontinuity of a limited space area. Therefore it is physically significant to speak of a localization of the energy in the gravitational field. It is not necessary to apply a quasi Galilei coördinate system in the calculation of the total energy of a closed system. By this means a well-defined treatment of the energy distribution and energy current within non-closed systems is provided. The gravitation waves form a significant example for this kind of system. The approximation of the non-linear field equations by the solution of linearized field equations is shown to be unsuitable for the treatment of the existence of energy-carrying gravitational waves. With respect to the well-known exact solutions of non-linear field equations for matter-free space, it was shown that these gravitational waves have a total energy of zero. This is strong support for the hypothesis that, in general, no energy-carrying gravitational waves exist. It is also understandable why the application of the usual quantizing methods to gravitational fields has led to no satisfactory results. (tr-auth)

17140

THE CLASSICAL RELATIVISTIC TREATMENT OF THE SPIN PROBLEM. J. Weyssenhoff (Uniwersytet Jagiellonski, Kraków). p.155-68 of "Max-Planck-Festschrift, 1958." (In German)

In consideration of the difficulties which still oppose the fusion of the fundamentals of the quantum theory and the relativity theory, the view is expressed that it would be of value to investigate thoroughly the area of the relativity theory which has not been completely studied up to the present. The Einstein-Mathisson relativistic point mechanics is especially indicated. By this is meant the method described by Mathisson for the extension of the Einstein-Grommer treatment of the singularities in the gravitational field as a model of mass point, however without the assumption of the static central symmetrical character of these singularities (in three dimensions, to the world line of the singularity of pseudoorthogonal hyperplanes). When the eigen field of particles in their direct reversal at each of the plane hyper planes is developed in a series of gravitational multipoles and only the first term is considered, the Einstein-Grommer "unipole particle" is obtained. In the addition of the second terms of the multipole series, motion equations higher than the second order are obtained. The motion forms which are derived exhibit many processes which are remarkable, such as the behavior of Dirac electrons. The fact that these motion equations must be supplemented by additional conditions to define the motion (in corresponding initial conditions) was emphasized. The condition $S_{\mu\nu} u^{\nu} = 0$ ($\mu, \nu = 1, 2, 3, 4$) (in which u^{ν} is the four component velocity of the particle) which is often introduced for the spin bivector (antisymmetric tensor of two ranges) is an example. The discussion of the various kinds of dipole particles must shed new light on the many disputed questions on the physical significance of this condition. (tr-auth)

17141

PERCEPTION QUESTIONS OF QUANTUM PHYSICS. N. Bohr (Universitetets Institut for Teoretisk Fysik, Copenhagen). p.169-75 of "Max-Planck-Festschrift, 1958." (In German)

The principal features of the development of classical physics are briefly considered with emphasis on the ideas of objectivity, determinism, and relativity. It is shown that quantum physics, in spite of its statistical character, fulfills the requirements on objectivity and completeness, and in this connection the necessity, in the description of indivisible quantum phenomena, of making a distinction in principle between the measuring apparatus and the object to be investigated is indicated. It is especially emphasized that the idea of complementarity expresses directly the logical situation within this research area and is interpreted as a generalization of the causality principle. It is indicated that aggregate methods in biology, psychology, and sociology require also a complementary description method. (tr-auth)

17142

THE SIGNIFICANCE OF QUANTUM MECHANICS. V. A. Fok (Fock) (Academy of Sciences, U.S.S.R., Leningrad). p.177-95 of "Max-Planck-Festschrift, 1958." (In German)

In the establishment and description of quantum physical processes reference to the observation means used is essential. This compels an abandonment of the classical mechanical determinism and makes a new formulation of the causality principle necessary. It is shown that the quantum theory should be considered as a fundamental expansion of the materialistic world form. On this basis all research on a new statement of the quantum theory in classical deterministic methods, which was often undertaken as a reaction against the idealistic interpretation of the quantum theory, appears unfeasible. The classical mechanical determinism is logically not compelling. Its predominance is explained more from the peculiarities of the historical development of science. The theoretical probability character of the declarations of the quantum theory remain completely in accord with the experiences practical living. The quantum mechanical causality principle, which represents a natural generalization of the classical causality principle, is related directly to the potential possibilities and the related wave functions and not to the actual events. (tr-auth)

17143

THE GREAT DISCOVERY OF MAX PLANCK: THE MYSTERIOUS CONSTANT h. L. de Broglie (Institut de France, Academie des Sciences, Paris). p.197-202 of "Max-Planck-Festschrift, 1958." (In French)

Planck introduced the constant h into physics as "the quantum of action." But soon after the formulation of the photon theory of light by Einstein, he showed that the constant h plays an essential role in the joining of the wave character and the corpuscular character of light. The development by wave mechanics has shown that the true significance of the constant h was, in effect, that of serving as a bond between the wave aspect of elementary units of matter and radiation. It has preserved this significance in the modern tests of nonlinear generalization of wave mechanics before the evolution of a theory of elementary units which can explain their structure and properties. The solution of this problem is apparently very complicated. But there is no doubt that the constant h is the keystone of the architecture of matter and radiation on the microphysical scale. (tr-auth)

17144

MAX PLANCK AND THE STATISTICAL DEFINITION OF ENTROPY. L. Rosenfeld (NORDITA, Copenhagen). p.203-11 of "Max-Planck-Festschrift, 1958." (In French)

The statistical definition of entropy by Boltzmann played a decisive role in the thoughts of Planck. The study of this aspect of his work is still today very instructional. In particular, the celebrated controversy, which was caused by the concept of absolute entropy, affects profound epistemological problems which are always real. The problems which Planck used to apply and develop his concepts on statistical thermodynamics are reviewed. (tr-auth)

17145

RADIATION AND GAS STATISTICS. K. F. Novobátzky (Eötvös Loránd Tudományegyetem Elméleti Fizikai Intézete, Budapest). p.213-24 of "Max-Planck-Festschrift, 1958." (In German)

The untenability of the assumption of the corpuscular nature of photons is discussed, and a derivation of the Planck radiation law is derived by a method which depends on no assumptions. The methods used are then applied to gases, a new quantum is obtained, and the superfluidity with respect to the Tisza theory is explained. (tr-auth)

17146

THE DEVELOPMENTS OF THE ERGODIC APPROACH TO STATISTICAL MECHANICS. P. Caldirola and A. Loinger (Universita, Milan and Universita, Pavia, Italy). p.225-36 of "Max-Planck-Festschrift, 1958."

The fundamental principles of classical and quantum statistical mechanics according to the ergodic method are discussed. As far as classical theory is concerned, it is concluded that the approach opened by the pioneer works of von Neumann and Birkhoff is basically adequate, though further developments are still needed in order to achieve really conclusive results. On the contrary, in the quantum theory an examination of the successive developments of von Neumann's approach to the ergodic theory shows that this approach is completely unable to give a dynamical justification of the microcanonical ensemble—as it has been recently proved. Lastly, a short account of the "master equations" approach to quantum statistical mechanics, according to van Hove, is given. (auth)

17147

THE THEORY OF MATTER UNDER HIGH PRESSURE. P. Gombás (József Nádor Műszaki És Gazdaságtudományi Egyetem, Budapest). p.237-42 of "Max-Planck-Festschrift, 1958." (In German)

It is shown that the theory of compressed atoms by expansion with the Weizsäcker correction with respect to the Thomas-Fermi and Thomas-Fermi-Dirac models shows an important change. If the atomic volume of free atoms is decreased, the energy first decreases, a minimum is reached, and the energy then increases. Correspondingly, the pressure first has negative values with decreasing atomic volume, at the energy minimum the pressure disappears, and then passes to positive values and increases very rapidly. The results derived on the basis of the Thomas-Fermi and the Thomas-Fermi-Dirac model for the pressure-density relationship of

matter, according to which the energy and therefore the pressure also increase constantly with the decrease of the atomic volume, are also undergoing a revision. (tr-auth)

17148

COLLAPSED MATTER OF NUCLEAR DENSITY AND NUCLEAR GOBLINS. F. Zwicky (Carnegie Institution of Washington and California Inst. of Tech., Pasadena). p.243-51 of "Max-Planck-Festschrift, 1958."

The nuclear reactions normally considered in the theory of stellar development do not explain the explosive production of energy in eruptive stars, in the atmosphere of the sun, and in the common novae and supernovae. The energies radiated from these stars range from about 10^{26} ergs to 10^{50} ergs and are given off in the course of a few hours, minutes, or even seconds by the source of energy which produces them. A new possibility for the explanation of eruptive stellar processes derives from an analysis of the close combination of various nuclear reactions with the action of gravity inside large and dense masses. Particularly the changes in volume, which are associated with reactions such as the decay of the neutron, imply that these reactions can be stopped and reversed under great pressure. A consequence of this is that gravitationally fully collapsed matter with nuclear density (10^{13} gr/cm^3) represents the most stable thermodynamic state of matter as such. Two critical masses are especially important for stellar development, firstly the neutron star, with a mass of the order of magnitude of the sun's and a radius of only a few kilometers, and secondly the nuclear goblins, whose characteristic mass is derived to be about 10^{21} grams and the radius about three meters. The collapse of normal stars or of large interstellar clouds of gas into a neutron star with the corresponding liberation of energy leads to an explanation of the phenomena associated with the supernovae; the decay of nuclear goblins which are ejected from the interior of a star to its surface can, on the other hand, supply us with an explanation for the sudden release of energy in the normal eruptive stars. (auth)

17149

THE DIFFERENTIAL EQUATION OF THE ELECTRIC CONDUCTIVITY OF METALS AT LOW TEMPERATURES. I. Supek (Institut Rudjer Bošković, Zagreb). p.253-76 of "Max-Planck-Festschrift, 1958." (In German)

By a consideration of the electron and phonon distribution in the electrical field at low temperatures, a differential equation of the Fermi surface can be obtained from the Bloch integral equation for the distribution function of electrons. In the collisions with the lattice, the wave vector of the electron undergoes only small changes, and the distribution function can be developed according to these small changes. If the Planck distribution for the phonon is retained, a relatively simple differential equation is obtained for the distribution of the electron. The equation gives the known Bloch solution for the spherical symmetry of the energy surface. This method can also be applied to general distributions of electrons and phonons. (tr-auth)

17150

PHENOMENOLOGICAL THEORY OF THE ENERGY LOSS OF FAST PARTICLES IN SOLIDS. H. Fröhlich (Univ. of Liverpool). p.277-84 of "Max-Planck-Festschrift, 1958."

The theory of the energy loss of fast particles in solids is developed on a phenomenological basis. For this purpose the solid is described in terms of a complex dielectric constant $\epsilon(\vec{\varkappa},\omega)$ which may depend on both frequency ω and wave vector $\vec{\varkappa}$. The rate of loss is given by the imaginary part of ϵ^{-1}. The result of the Bohr-Bethe theory is obtained when ϵ is assumed independent of $\vec{\varkappa}$; they are subject, however, to two modifications which are due to the electrostatic interaction of the polarization waves excited by the primary particle. They concern (i) a screening of the charge of the primary particle and (ii) a shift of the discrete energy levels as compared with levels which can be excited optically. Classically this corresponds to the frequency difference between longitudinal and transverse modes. This difference does not exist in the case of ionization. (auth)

17151

INTERFERENCES OF INCOHERENTLY SCATTERED ELECTRONS. O. Scherzer (Technischen Hochschule, Darmstadt, Ger.). p.285-90 of "Max-Planck-Festschrift, 1958." (In German)

An investigation to detect the interferences in the "incoherent background" of electron diffraction is discussed. The evaluation, in agreement with the quantum theory, shows that two coherent waves do not lose their interference capacity when they are scattered inelastically on similar electrons. (tr-auth)

17152

THE STRUCTURE OF ELEMENTARY PARTICLES. D. I. Blokhintsev (Blochinzew) (Joint Inst. of Nuclear Studies, Dubna, U.S.S.R.). p.291-6 of "Max-Planck-Festschrift, 1958." (In German)

The determination of the structure of an elementary particle by means of the elastic scattering of any radiation is discussed. The "non-local" theories are criticized, and it is shown that the introduction of a "universal length," which would be decisive for the nonlocality, is unconfirmed. The conception of the "black sphere" is defined in relativisitic invariant methods as that area which includes the range in which the radiations are completely absorbed. With the use of the propagation function of the photon it is finally shown that the form factor of the optical image at high energies does not occur with weak interaction but with strong interaction of elementary particles. (tr-auth)

17153

SOME REMARKS ON ULTRAVIOLET DIVERGENCIES. E. R. Caianiello (Università, Naples and C.N.R.N., Naples). p.297-307 of "Max-Planck-Festschrift, 1958."

A general survey is presented of a rigorous mathematical method, which permits the study of the nature of the ultraviolet divergencies which appear in quantized field theories, starting from fundamentals. All expansions in terms of Feynman graphs are avoided, and the method is shown to be independent of the use of perturbative expansions. The connection with the usual procedures, as well as with the distribution-theoretical approach, is indicated. Emphasis is placed on the bearing that this investigation has on the question of the physical relevance of the ultraviolet divergencies. The conclusion which is attained by showing that this method is the appropriate extension to infinite systems of coupled hyperbolic equations of procedures already well known in the case of single hyperbolic equations, is that such divergencies are not inherent in the equations, but are due to the mathematical techniques com-

monly used to solve them; and that they can be entirely avoided if the concept of the integral is suitably modified, as is required by the mathematical structure of the equations. (auth)

17154

LONGITUDINAL POLARIZATION OF DIRAC PARTICLES AND NON-CONSERVATION OF PARITY. A. Sokolov (Lomonosov Moscow State Univ.). p.309-20 of "Max-Planck-Festschrift, 1958." (In German)

After a brief survey of the invariance properties of the Dirac equation with respect to spatial reflection, time reversal, and charge conjugation, the theory of the Dirac particle with oriented spin is presented. The theory of neutrinos is thoroughly developed, and the invariance properties of the pertinent equations are investigated. The theory of neutrinos with oriented spin permits an understanding from the general viewpoint of the theory developed by Lee and Yang on the non-conservation of parity in weak interaction and also permits the representation of various variants of such theories, which is of importance with respect to the still scant experimental material on weak interactions. (tr-auth)

17155

QUANTUM THEORY AND GEOMETRY. M. Schönberg (Universidade de São Paulo, Brazil). p.321-38 of "Max-Planck-Festschrift, 1958."

The mathematical formalisms of the quantum mechanics and the quantum field theory are interpreted as special kinds of geometric algebras closely related to vector calculus and to the calculus of points. The algebras of operators of the quantized fields appear as geometric calculi of general three-dimensional spaces. It is shown that the operators and states of the quantal systems and fields have rather simple geometrical meanings. The present relations between quantum physics and the geometry of the space-time are essentially different from those involved in the general theory of relativity and the classical unified field theories, for they depend on the finite value of the Planck constant. The geometrization of quantum physics requires a further development of the ordinary theory of space and the introduction of new kinds of geometric objects corresponding to the quantum states. The operators describing the physical quantities are, however, related to simple intuitive geometric objects, such as points, vectors, trihedrals and spheres. The present geometrical approach leads to a fusion of the Heisenberg and Schrödinger pictures of the quantal motion, the states being described by elements of the geometric algebras and the observables too. The kinematical aspects of the quantum theory have already been extensively discussed along the present lines, but the treatment of the dynamic ones is still rudimentary, especially with respect to the interactions between fields. The relations between the present geometric theory and the general relativity are as yet not known. (auth)

17156

THE ELECTRON WAVE EQUATION IN RIEMANN SPACE. P. A. M. Dirac (St. John's Coll., Cambridge, Eng.). p.339-44 of "Max-Planck-Festschrift, 1958."

The formulation of the relativistic wave equation of the electron in terms of Hermitean matrices has some advantages. The generalization of this formulation to Riemann space, so as to bring in the gravitational field, in as direct a manner as possible is investigated. The physical interpretation of the wave equation is also discussed. (auth)

17157

SOME PHYSICAL AND MATHEMATICAL PROPERTIES OF A NON-LOCALIZABLE FIELD. G. Heber (Friedrich-Schiller-Universität, Jena, Ger.). p.345-52 of "Max-Planck-Festschrift, 1958." (In German)

A method for fulfilling the new exchange rules for a field theory, previously introduced, is shown. The direction with respect to these exchange rules in which simple solutions of classical field equations must be changed is also discussed. (tr-auth)

17158

REMARKS ON A HOMOGENEOUS NON-LINEAR THEORY OF MATTER. D. Ivanenko (Iwanenko) (Lomonosov Moscow State Univ.). p.353-69 of "Max-Planck-Festschrift, 1958." (In German)

The present investigations of a homogeneous description of collective elementary particles in the framework of a non-linear spinor theory started from three different assumptions: the non-linear generalization of electrodynamics by Mie, Born, and Infeld and an analogous expansion of mesodynamics, the fusion theory of de Broglie, and the theory of compound particles by Fermi-Yang, Goldhaber, Sakata, and others. After the treatment of the various possibilities on the non-linear expansion of the Dirac equation, a brief survey of the further development of the non-linear theory by Heisenberg is given. The induced vacuum non-linearity of the meson and gravitation theory and some simple solutions of non-linear field equations are discussed. (tr-auth)

17159

THE CONCEPT OF QUANTIZATION. J. L. Destouches (Institut Henri Poincaré, Paris). p.371-84 of "Max-Planck-Festschrift, 1958." (In German)

After a brief survey of the development which the concept of quantization has followed since the formulation of the original quantum theory by Max Planck, quantization in the functional theory of elementary particles is explained. From this theory one can attain a non-linear generalization of the Maxwell theory of electromagnetism. It was indicated how a bridge between the general relativity theory and the quantum theory can be prepared from the functional theory by means of a non-linear theory of the graviton. In all the development which the formulation of the quantum theory has undergone, the effective quantum introduced by Planck has retained its basic meaning. It is to be expected that for a long time it will determine the direction of research. (tr-auth)

17160

QUANTUM THEORY AND CHEMISTRY. L. Pauling (California Inst. of Tech., Pasadena). p.385-8 of "Max-Planck-Festschrift, 1958."

Since chemistry is wholly a molecular science, there is no part of this science that does not depend in its fundamental theory upon quantum principles. Quantum theory has led to a penetrating understanding of the classical structure theory and to a set of new ideas grouped together under the name of the theory of resonance in chemistry. A brief account on the theory of resonance is given and it is pointed out how it differs from the theory of resonance in physics. (auth)

17161

PLANCK'S PHILOSOPHICAL OPINIONS IN PHYSICS. L. Jánossy (Hungarian Academy of Sciences, Central Research Inst. for Physics, Budapest). p.389-407 of "Max-Planck-Festschrift, 1958." (In German)

A survey on the basic philosophical concepts of Max

Planck is given, and it is shown that, in so far as it is a question of the area of physical knowledge, it is in agreement, in its essential points, with the viewpoint of dialectical materialism. The principal opinions of Planck on the basic questions of the quantum theory which, as a result of the latest developments in this area of physics, are of special interest today are indicated. (tr-auth)

Elementary Particles

17162 AFOSR-TN-59-534

Princeton Univ., N. J. and Purdue Univ., Lafayette, Ind.
ON THE EVALUATION OF DISPERSION RELATIONS.
R. Blankenbecler and S. Gartenhaus. 32p. Contract AF18(600)-1579. (AD-216551).

A new evaluation of the dispersion relations for mesonic phenomena is proposed. The method, which utilizes the comparison function procedure, makes explicit use of crossing symmetry and allows for an exact treatment of nuclear recoils. For the case of meson nucleon scattering at low energies an expansion of a first order solution is made in inverse powers of the nucleon mass and agreement with the results of a previous evaluation is obtained. The extension of the method to other processes is briefly discussed. (auth)

17163 ASAE-35

American-Standard. Atomic Energy Div., Mountain View, Calif.
SPECTRUM OF NEUTRONS MODERATED BY HEAVY WATER AT CRYOGENIC TEMPERATURES. E. J. Leshan, J. R. Burr, and L. J. Barbieri. [1958?]. 30p. $4.80(ph), $2.70(mf) OTS.

A calculation was made, using the Monte Carlo method, to determine the transmission of neutrons through blocks of deuterium oxide at cryogenic temperatures. Computations were made for cylinders of D_2O ice at four degrees absolute, 60 and 75 centimeters long, and 45 centimeters in diameter. The incident neutrons impinged uniformly over one flat surface with an incident intensity proportional to the cosine of the angle between the direction of motion of the particles and the normal to the surface. Their energy distribution was a Maxwellian at a temperature of 300° absolute. In the initial trials of this calculation, it was found that more than 90% of the incident neutrons were reflected out of the surface of the block at which they had entered. Since in actual use the block will be placed against the thermal column of a reactor, it was clear that the treatment of the incident face as a free surface was not realistic. Such a highly reflecting system would have a marked effect on the flux in the source region, and the material of the thermal column, further, would reflect most of these neutrons back into the D_2O ice. In order to more adequately represent the physical situation, the program was modified so that neutrons attempting to leak out of this surface were optically reflected back into the system. (auth)

17164 CEA-760

France. Commissariat à l'Énergie Atomique, Paris.
ÉTUDE, AU PHOTOMULTIPLICATEUR, DES SCINTILLATIONS PRODUITES PAR LES PARTICULES "ALPHA" DANS UN ÉCRAN DE SULFURE DE ZINC. APPLICATION A LA NUMÉRATION PRÉCISE DES PARTICULES "ALPHA." (The Study by Means of a Photomultiplier of the Scintillations Produced by α Particles Striking a Zinc Sulphide Screen. Application to the Precise Counting of "Alpha" Particles.)
Jean-Pierre Anthony. 1958. 55p.

Thesis submitted to Univ. of Paris.

A study is made of the accurate counting of α particles by photomultiplier detection of the scintillations produced by these particles on impact with a zinc sulfide screen. The principal advantage of the method is the extreme simplicity of the electronic apparatus. It is shown that it is possible to obtain with a linear response a pulse from the photomultiplier which is usable without any amplification. The scintillation produced by the impact of α particles on a ZnS screen is studied experimentally. The decrease of light intensity as a function of time may be interpreted by the exponential relationship $I = I_0 \exp(-t/\tau)$ with $\tau = (39 \pm 0.1) \times 10^{-6}$ sec. The relationship between the scintillation intensity and the trajectory remaining after passage through a given thickness of air is also determined. The possible applications of this method of counting α particles are for those studies which require good stability and low background. The results given are of value in studies of air contamination, measurement of variations in the isotopic composition of uranium, and determination of bismuth in alloys by irradiation in slow neutron flux and counting of α particles emitted by the polonium which is formed. (tr-auth)

17165 CERN-Bib-4

European Organization for Nuclear Research, Geneva.
TIME REVERSAL. A Bibliography. H. Coblans, [comp]. May 30, 1959. 15p.

Papers are included which have appeared in the scientific press, the proceedings of conferences, and reports noted in Nuclear Science Abstracts (A.C.)

17166 NP-7695

Rio de Janeiro. Centro Brasileiro de Pesquisas Físicas and Brazil. Universidade, Rio de Janeiro. Faculdade Nacional de Filosofia.
ON ANOMALOUS MAGNETIC MOMENT OF NUCLEONS. Colber G. De Oliveira. 1959. 14p. (Notas de Física Vol. V, No. 5).

An evaluation of the nucleon magnetic moments by application of the mass operator formalism of Schwinger is presented. The mass operator describes the mass or self-energy of the particle in interaction with an external electromagnetic field. Taking a constant (in time and space) external field acting on the particle, the expectation value of this operator, computed to the desired order of approximation, contains a term linear in the magnetic field, and the magnetic moment is the coefficient of this term. (J.R.D.)

17167 UCRL-8778

California. Univ., Berkeley. Lawrence Radiation Lab.
POSITIVE-PION PRODUCTION BY NEGATIVE PIONS (thesis). Walton A. Perkins, III. June 4, 1959. 60p. Contract W-7405-eng-48. $1.75(OTS).

A liquid hydrogen target was bombarded by negative pions of energies 260, 317, 371, and 427 Mev. Positive π mesons from the reaction $\pi^- + p \rightarrow \pi^+ + \pi^- + n$ were detected by using a counter telescope which selected the π^+ by its characteristic π-μ decay. With the 260-Mev beam π^+ mesons were counted at 90° in the laboratory system. At 317, 371, and 427 Mev the differential cross section was measured for π^+ mesons emitted at 60, 90, 125, and 160° in the barycentric system. The angular distributions are nearly isotropic at 317 and 371 Mev but are peaked forward at 427 Mev. The total cross sections are: 0.14 ± 0.10 mb at 260 Mev; 0.71 ± 0.17 mb

at 317 Mev; 1.93 ± 0.37 mb at 371 Mev; and 3.36 ± 0.74 mb at 427 Mev. These results indicate a much larger cross section than the theoretical prediction based on the static model. Reasonable agreement can be obtained by the inclusion of a pion-pion interaction in the production mechanism. (auth)

17168

MEASUREMENTS ON DIFFUSION AND SLOWING DOWN LENGTHS IN WATER. András Ádám and Lajos Bata. Magyar Tudományos Akad. Központi Fiz. Kutató Intézetének Közleményei 6, 3-13(1958) Jan.-Apr. (In Hungarian)

Diffusion and slowing down lengths in water were determined. The results gave the diffusion length as $L_D = 2.81 \pm 0.009$ cm and the length for slowing down to thermal energies as $L_S = 7.93 \pm 0.08$ cm. The relaxation length in water for a Po–Be neutron source was found to be 11.16 ± 0.01 cm. (auth)

17169

ON SOME PROBLEMS RELATING TO THE DETERMINATION OF DIFFUSION AND SLOWING DOWN LENGTHS. András Ádám and György Kosály. Magyar Tudományos Akad. Központi Fiz. Kutató Intezetének Közleményei 6, 14-21(1958) Jan.-Apr. (In Hungarian)

Definitions of the slowing down length $L_S(E)$, diffusion length L_D, and migration length L_M are given, and problems in measurements of $L_S(E) > E_{th}$ are studied. These problems are connected with the fact that in hydrogenous media the slowing down density is not proportional to neutron density. The asymptotical behavior of thermal neutrons produced by a fast neutron source in measurements of L_M is considered. From this knowledge some guidance is obtained for measuring L_D in hydrogenous media. (auth)

17170

INVESTIGATION OF EXTENSIVE AIR SHOWERS CONTAINING NUCLEAR ACTIVE PARTICLES. György Bozoki, Ervin Fenyves, Tamás Sándor, and Antal Somogyi. Magyar Tudományos Akad. Központi Fiz. Kutató Intézetének Közleményei 6, 36-48(1958) Jan.-Apr. (In Hungarian)

The exponent of the density spectrum of the electronic component of extensive air showers containing nuclear active particles was determined to be $\gamma = 1.34 \pm 0.08$ assuming that the density of nuclear active particles is proportional to the density of electrons in air showers. The agreement of the exponent found in the present experiment, with that determined earlier for extensive air showers $\gamma = 1.43 \pm 0.02$ with the same arrangement supports this assumption. The results indicate that the density spectrum of nuclear active particles has the form of a power law with an exponent approximately equal to γ. The decoherence curve between the electron and nuclear active particle detectors was measured. The experimental results are briefly discussed. (auth)

17171

MEASUREMENT OF THE ABSORPTION LENGTH OF PENETRATING SHOWER PRODUCING COSMIC RAY PARTICLES IN LEAD. G. Bozóki, E. Fenyves, and L. Jánossy (Central Research Inst. of Physics, Budapest). Nuclear Phys. 11, 531-9(1959) June (1).

The absorption length of penetrating shower producing particles was measured in lead under great absorber thicknesses by means of a penetrating shower detector. In order to select single nuclear active particles, local penetrating showers were detected, and the coincidence rates measured were corrected for spurious effects. The absorption length was found to be 414 ± 17 g/cm², in good agreement with the results of other experiments. The mean energy of the recorded penetrating shower producing particles was estimated to be between 30 and 60 Bev. (auth)

17172

POLARIZATION OF HIGH ENERGY PROTONS IN ELASTIC AND INELASTIC SCATTERING. Arne Johansson, Gunnar Tibell, and Peter Hillman (Univ. of Uppsala). Nuclear Phys. 11, 540-53(1959) June (1).

The polarizations of 180-Mev protons elastically and inelastically scattered by lithium, beryllium, boron, iron, and bismuth were measured with an energy resolution of 2 to 2.5 Mev full width at half height. The polarizations of scattered protons corresponding to the low-lying levels closely resemble each other and previous results for carbon, oxygen, and calcium. Good agreement is found when the data are compared with existing theoretical calculations. The elastic polarizations agree fairly well with measured asymmetries at those points where a comparison can be made. (auth)

17173

ENERGY AND ANGULAR DISTRIBUTIONS OF MESONIC HYPERFRAGMENT DECAYS. N. Byers and W. N. Cottingham (Univ. of Birmingham, Eng.). Nuclear Phys. 11, 554-68 (1959) June (1).

The distribution in energy and angle for the decay ${}_\Lambda He^5 \rightarrow \pi^- + p + He^4$ was investigated. It is shown that the angular asymmetry observed in three-pronged hyperfragment decays of this type can result from low-energy nuclear resonances (compound nucleus formation). Angular and energy distributions for the decay ${}_\Lambda He^5 \rightarrow \pi^- + p + He^4$ are presented, neglecting pion interactions. The form of these curves is largely determined by the fact that there is a low-energy $P_{3/2}$ resonance in proton-He^4 scattering. Effects due to parity violation and pion interactions are discussed and it is found that they will not produce any significant qualitative effects. (auth)

17174

ON THE ELECTRON-MUON MASS DIFFERENCE. I. Saavedra (Univ. of Manchester, Eng.). Nuclear Phys. 11, 569-73(1959) June (1).

On the basis of a previously developed formalism it is shown that a hypothetical (uncharged) boson isoscalar would remove the electron-muon mass degeneracy. (auth)

17175

FOCUSING OF PARTICLES IN THE OPTICAL MODEL. Ian E. McCarthy (Univ. of Minnesota, Minneapolis). Nuclear Phys. 11, 574-83(1959) June (1).

The behavior of the quantal flux of neutrons in a typical optical model potential is examined as the energy is increased from 5 to 30 Mev. At the higher energies the behavior can be described quite well by geometrical optics using the classical trajectories of the neutrons. The classical focus is reproduced quantally both in its general shape and its behavior with varying energy and potentials. There are also standing wave effects near the far edge of the nucleus which cannot be understood classically. The relative probability of reactions occurring in different angular regions and in different radial regions is estimated by integrating the divergence of the flux over these regions. (auth)

17176

PAIS DOUBLETS AND THE UNIVERSAL FERMI INTERACTION. J. C. Polkinghorne (Trinity College, Cambridge, Eng.). Nuclear Phys. 11, 599-603(1959) June (1).

A universal Fermi interaction responsible for all weak decays is investigated in terms of Pais's doublet representation of baryons. Some understanding may be gained of the apparently anomalous hyperon-leptonic decays and some of the consequences of the $\Delta I = \frac{1}{2}$ rule are simulated. One of the two alternative schemes proposed would lead to a direct decay mode for Ξ particles into nucleons and pions. (auth)

17177

PARITY NON-CONSERVATION AND THE ALGEBRA OF ELEMENTARY PARTICLES. Katsuhiko Sekine (University of Tokyo). Nuclear Phys. 11, 604-14(1959) June (1).

An attempt is made to incorporate the phenomenological expression for the observed non-conservation of parity into the property of the algebra of elementary particles and to reconstruct the theory on the basis of the new algebra, which is now characterized by the non-unitarity of representation for the improper Lorentz group. (auth)

17178

THE α, α INTERACTION. E. Van Der Spuy (Stellenbosch Univ., Union of South Africa). Nuclear Phys. 11, 615-24(1959) June (1).

The 8-body problem of the (α,α) scattering interaction is formulated by using the group resonance formalism, with two unpolarized α groups, and with the central nucleon-nucleon exchange force and α wave-function both having a gaussian radial dependence. Choosing parameters as far as possible the same as required by the low energy nucleon-nucleon data, the α binding energy, and the (α,n) scattering interaction, it was attempted to explain the S and D phases for low energy (α,α) scattering which was previously found to require a velocity-dependent interaction. The (α,α) scattering requires slightly different values of $y = 4w + 2b - 2h - m$, both of which are lower than required by the (α,n) problem. It is shown that the S wave interaction essentially behaves as a potential at low energies. For low energies this potential effectively has a repulsive core with an attractive outside well—features which also emerged from a previous purely phenomenological analysis. (auth)

17179

THEORY OF THE COSMIC RAY EQUATOR. R. Ingraham (New Mexico State Univ., State College). Nuovo cimento (10) 12, 356-68(1959) May 16.

The 45° westward shift of the cosmic ray equator from the geomagnetic equator is explained by assuming that there exist ionized atmospheric layers which rotate more slowly than the earth. The resultant magnetic field beyond the layers is then a dipole field whose magnetic north pole is west of the familiar geomagnetic north pole. The condition that this longitudinal shift be 45° determines $\Delta\omega \equiv \omega' - \omega$ as a function of certain radial moments of the conductivity of the layer (ω',ω = rotational velocities of layer and earth, respectively). The effect would vanish if either $\Delta\omega = 0$ or if the earth's intrinsic dipole axis were not tilted. (auth)

17180

SEARCH FOR AN ELECTRIC DIPOLE MOMENT OF THE ELECTRON. D. F. Nelson, A. A. Schupp, R. W. Pidd, and H. R. Crane (Univ. of Michigan, Ann Arbor). Phys. Rev. Letters 2, 492-5(1959) June 15.

Experimental upper limits on the size of an EDM for several elementary particles have been found. A summary of these limits is tabulated. Garwin and Lederman have suggested that the method used in searching for the muon EDM could be extended to higher accuracy for the electron. The anomalous magnetic dipole moment experiment of Schupp et al. is an experiment of this type. It is shown that this experiment does yield a new upper limit on the size of the EDM of the electron. Extensions of the same experiment, which are expected to considerably increase sensitivity, are described. (A.C.)

17181

ANGULAR DISTRIBUTIONS OF PHOTOPIONS FROM HYDROGEN. Edward A. Knapp, Robert W. Kenney, and Victor Perez-Mendez (Univ. of Calif., Berkeley). Phys. Rev. 114, 605-11(1959) Apr. 15.

An accurate measurement of the differential cross section for the photoproduction of positive pions from protons has been made at the Berkeley synchrotron for photon energies of 260 and 290 Mev. The mesons were produced in a thin-walled liquid-hydrogen target, and the meson-detection apparatus utilized the characteristic decay of the pion. The measurements were done in two steps, from 0 to 50° with equipment specifically designed to reduce a very high forward-angle positron background, and from 30 to 160° with equipment whose efficiency and solid angle could be accurately determined. The abrupt flattening of the observed cross section in the region forward of 40° is due to "photoelectric ejection" of pions from the cloud surrounding the nucleon. The results are compared to the theory of photoproduction derived from the dispersion relations, and the agreement is satisfactory within the limitations of the theory. (auth)

17182

STUDY OF θ_1^0 PRODUCTION AND DECAY BY OBSERVATION OF ITS NEUTRAL DECAY MODE. John E. Osher, Burton J. Moyer, and Sherwood I. Parker (Univ. of California, Berkeley). Phys. Rev. 114, 612-20 (1959) Apr. 15.

The production of strange particles possessing neutral-pion decay products has been investigated in proton bombardment of Bevatron targets. A well-collimated telescope counted energetic gamma photons originating within a few centimeters of the target. The position-dependent counting rate was determined by moving the telescope and collimation on a track parallel to the beam direction, and the resulting data were then compared to curves calculated from certain assumed kinematical models consistent with associated production. The counting rate and its variation with position were consistent with the identification of $\theta_1^0 \rightarrow 2\pi^0$, which implies even spin and even parity. The data also allow some gamma-ray contributions from $\theta^+ \rightarrow \pi^+ + \pi^0$, $\Sigma^+ \rightarrow p + \pi^0$, and $\Lambda^0 \rightarrow n + \pi^0$. The ratio of intensities from regions "upstream" to those "downstream" from the target implies a strongly peaked angular distribution, forward and backward, in the reference frame of the colliding nucleons which produce the θ_1^0. (auth)

17183

COULOMB EFFECTS IN BOSON EMISSION. Michael J. Moravcsik (Univ. of California, Livermore). Phys. Rev. 114, 621-5(1959) Apr. 15.

The corrections in boson emission processes due to Coulomb forces between the two particles are considered. The usual "Coulomb penetration factor" is modified by relativistic and finite-size effects. Numerical results are given for the emission by a nucleon of pions and K mesons in S and P states. It is emphasized, however, that in the absence of precise knowledge about the mechanism of emission the present numerical results should be considered only approximate. (auth)

17184

POLARIZABILITY OF THE NEUTRON. R. M. Thaler (Los Alamos Scientific Lab., N. Mex.). Phys. Rev. 114, 827-9(1959) May 1.

Experiments on scattering of low-energy neutrons by heavy elements may give information concerning the electric polarizability of the neutron. The relation of the electric polarizability to the low-energy neutron scattering data is developed. One pertinent experiment is discussed and from this an upper bound on the polarizability is obtained. This upper bound to the polarizability α is an order of magnitude larger than the meson-theoretic estimate of α. If the value of α is as small as is predicted by meson theory, or by an analysis of the pion photoproduction data, then it is unlikely to be observed in neutron scattering experiments of the presently achievable accuracy. (auth)

17185

ON THE HYPERON-NUCLEON SCATTERING AND REACTION CROSS SECTIONS. Fabio Ferrar (Univ. of California, Berkeley) and Luciano Fonda (Indiana Univ., Bloomington). Phys. Rev. 114, 874-7(1959) May 1.

The hyperon-nucleon cross sections are analyzed on the basis of symmetries among the pion-baryon interactions. It is shown that the assumption of the equality for the $(\Lambda\Sigma\pi)$ and $(\Sigma\Sigma\pi)$ coupling constants leads to some inequalities between the different hyperon-nucleon scattering and reaction cross sections which can be verified experimentally. On the hypothesis of global symmetry for the pion-baryon interactions, the Σ^+-proton scattering is discussed by choosing for the nucleon-nucleon potential that of Gammel-Thaler. (auth)

17186

ASYMMETRY IN THE DECAY OF Σ HYPERONS. R. L. Cool, Bruce Cork, James W. Cronin, and William A. Wenzel (Univ. of California, Berkeley). Phys. Rev. 114, 912-20(1959) May 1.

A search has been made for an asymmetry in the decay of $\Sigma^{\pm}$ hyperons. The $\Sigma^{\pm}$ were produced in the reactions $\pi^{\pm} + p \rightarrow \Sigma^{\pm} + K^+$. Detection and identification of the K^+ mesons by a counter technique selects the above reactions and establishes the plane of production. Additional counters, which detect the pions from the Σ-hyperon decay in coincidence with the K^+ mesons, measure the symmetry with respect to the plane of production. The results yield the parameter $\alpha\overline{P}$, where α measures the strength of parity nonconservation and $\overline{P}$ is the average polarization of the Σ hyperon. The data give: for Σ^- produced by 1.0-Bev π^-, $\alpha^-\overline{P} = +0.02 \pm 0.05$; for Σ^- from 1.1-Bev π^-, $\alpha^-\overline{P} = -0.06 \pm 0.05$; for Σ^+ from 1.0-Bev π^+, the decay mode $\Sigma^+ \rightarrow \pi^+ + n$ gives $\alpha^+\overline{P} = +0.02 \pm 0.07$ and the mode $\Sigma^+ \rightarrow \pi^0 + p$ gives $\alpha^0\overline{P} = +0.70 \pm 0.30$. The value of $\alpha^0\overline{P}$ for $\Sigma^+ \rightarrow \pi^0 + p$ strongly indicates that parity is not conserved. For the Σ^+, $|\overline{P}| \geq 0.70 \pm 0.30$; thus we can conclude $|\alpha^+| \leq 0.03 \pm 0.11$. The results therefore indicate that the asymmetry parameter α depends upon the isotopic spin states in the final pion-nucleon system. The dependence on the isotopic spin is compatible with the $\Delta I = \pm 1/2$ rule. (auth)

17187

PHOTOPRODUCTION OF K MESONS AND K-HYPERON PARITIES. Richard H. Capps (Cornell Univ., Ithaca, N. Y.). Phys. Rev. 114, 920-4(1959) May 1.

An investigation is made of the possibility of determining the intrinsic parities relative to the nucleon of $K-\Lambda$ and $K-\Sigma$ pairs by measuring the cross sections for photoproduction of these pairs from nucleons near threshold. The low-energy S and P wave contributions are calculated in a perturbation theory similar to that of Kawaguchi and Moravcsik. The question concerning the combination of nucleon and hyperon magnetic moments that is effective in the process is clarified. The calculated cross sections are quite different from those given in the long photon wavelength approximation by Feld and Costa. For most reasonable choices of the hyperon anomalous magnetic moments, certain calculated ratios of the close-to-threshold cross sections corresponding to different $K-\Lambda$ and $K-\Sigma$ charge states are quite sensitive to the K-hyperon parity. A model, in which the anomalous moments are the result of globally symmetric pion interactions, is used to illustrate the conclusions. (auth)

17188

INNER BREMSSTRAHLUNG IN HYPERON DECAYS. S. Barshay and R. E. Behrends (Brookhaven National Lab., Upton, N. Y.). Phys. Rev. 114, 931-5(1959) May 1.

The angular distribution, energy spectrum, and total rate for the pion modes of hyperon decay with inner bremsstrahlung are calculated. The contributions from static anomalous magnetic moments are also included. In principle, it is then possible to experimentally determine the one unknown parameter of the problem—the static anomalous magnetic moment of the hyperon. (auth)

17189

STIMULATED EMISSION OF RADIATION BY RELATIVISTIC ELECTRONS IN A MAGNETIC FIELD. Jürgen Schneider (Duke Univ., Durham, N. C.). Phys. Rev. Letters 2, 504-5(1959) June 15.

The Schroedinger equation of an electron, moving perpendicularly to a magnetic field H, can be reduced to the equation of the harmonic oscillator. Using the relativistic Schroedinger equation and neglecting the spin, equations are found for the kinetic energy levels of the electron. Formulas were derived by means of the Boltzman transfer equation, taking into account the dependence of the electron mass on kinetic energy. (A.C.)

17190

ANTIPARTICLES IN SPACE. Edward W. Hones, Jr. (Convair, San Diego, Calif.). Phys. Rev. Letters 2, 509-10(1959) June 15.

Hoyle obtained a steady-state model for an expanding universe by introducing continuous creation of matter into the field equations of general relativity. Morrison has speculated that the creation of matter throughout the universe may take place by formation of particle—anti-particle pairs which subsequently are segregated by a repulsive force between matter and anti-matter. Burbidge and Hall have estimated that the ratio of anti-matter to matter in our galaxy can not exceed $\sim 10^{-7}$. This investigation points out that a slightly more strin-

gent limit for this ratio is suggested by cosmic ray measurements. More precise information concerning the density of antiparticles in the galaxy can be obtained by carrying a simple scintillation gamma spectrometer some distance from the earth in a satellite or space probe. (A.C.)

17191

K-MESON NUCLEON INTERACTION. Robert Karplus, Leroy Kerth, and Thaddeus Kycia (Univ. of California, Berkeley). Phys. Rev. Letters 2, 510-13(1959) June 15.

The most promising method of analysis for determining the coupling constants and relative parities of particles exploits the analyticity properties of various reaction amplitudes. The recently measured angular distribution of the K^+–proton scattering cross section at various intermediate energies and the K^-–proton parameters make it possible to make a study of K–nucleon–hyperon coupling terms. The K^-–proton force is attractive, but the accuracy is not sufficient to lead to a definite conclusion about K-meson parity. (A.C.)

17192

PRECISE DETERMINATION OF THE MUON MAGNETIC MOMENT. R. L. Garwin, D. P. Hutchinson, S. Penman, and G. Shapiro. Phys. Rev. Letters 2, 516-17(1959) June 15. (Erratum to Phys. Rev. Letters 2, 213(1959)).

It was recently found that the theoretical uncertainties in the lower limit of the muon mass from mesonic α rays are much smaller than previously supposed. A careful search into possible symmetric errors in moment measurements was undertaken. One serious source of error was found and corrected. A method of testing was designed which simulated the experimental situation and permitted the establishment of an upper limit on the remaining systematic errors in the electronic equipment. The circuit design used is described. (A.C.)

17193

ATOMIC MOTIONS IN WATER BY SCATTERING OF COLD NEUTRONS. D. J. Hughes, H. Palevsky, W. Kley, and E. Tunkelo (Brookhaven National Lab., Upton, N. Y.). Phys. Rev. Letters 3, 91-3(1959) July 15.

The technique of using the scattering of very slow or "cold" neutrons for studying motions of atoms in solids and liquids is described. A beam of approximately 0.005-ev neutrons, produced by beryllium filtration, is incident on a thin sample. Measurement of the changes in energy at scattering gives directly the desired information concerning the atomic motions in the sample. The cold-neutron method was applied to water because of the intrinsic interest of the atomic motions and because the inelastic scattering of neutrons in water has an important bearing on its function as a reactor moderator. The spectrum of scattered neutrons is graphically shown on a time-of-flight scale. (A.C.)

17194

A FORMAL OPTICAL MODEL. J. S. Bell and E. J. Squires (Atomic Energy Research Establishment, Harwell, Berks, Eng.). Phys. Rev. Letters 3, 96-7(1959) July 15.

A construction is given of an equivalent one-body potential for the elastic scattering of a particle incident on a complex target. The case of incident and target particles being identical nonrelativistic fermions, and allowing fully for antisymmetry, is considered explicitly. (A.C.)

17195

PROTON-NEUTRON INTERACTION AND THE (p,n) REACTION IN MIRROR NUCLEI. S. D. Bloom (Univ. of California, Livermore), N. K. Glendenning (Univ. of California, Berkeley), and S. A. Moszkowski (Univ. of California, Los Angeles). Phys. Rev. Letters 3, 98-9(1959) July 15.

Direct-interaction reactions have been treated by a number of authors from the point of view of obtaining information concerning spins and parities of excited states of nuclei. A new use of this type of reaction—a study of the direct interaction itself—is pointed out. The direct interaction referred to is the effective neutron-proton potential within the nucleus. The (p,n) reactions on mirror nuclei are discussed as a particularly promising source of information on this effective interaction. (A.C.)

17196

PREDICTION OF DEUTERON POLARIZATION FROM d-α SCATTERING. R. J. N. Phillips (Atomic Energy Research Establishment, Harwell, Berks, Eng.). Phys. Rev. Letters 3, 101-2(1959) July 15.

There is current interest in possible means of producing and analyzing deuteron polarization. Studies of d-α scattering on the 1.07-Mev resonance and the $T(d,n)He^4$ reaction show that d-α scattering can be a useful producer (and analyzer) of deuteron polarization at energies between resonances, where the weak energy dependence may be an advantage. The phase shifts of Galonsky and McEllistrem, deduced from differential cross sections with the help of dispersion theory, were used to calculate dispersion parameters in the interval between the resonances at 1.07 and 4.6 Mev. (A.C.)

17197

$_{\Lambda}H^4$ HYPERFRAGMENT EMITTED FROM AN ANTIPROTON CAPTURE STAR. A. G. Ekspong, A. Frisk, and B. E. Ronne (Inst. of Physics, Uppsala). Phys. Rev. Letters 3, 103-4(1959) July 15.

The observation of a definite case of Λ° hyperon emission from an antiproton annihilation in a medium heavy nucleus is reported. The Λ is emitted as a $_{\Lambda}H^4$ hyperfragment. The event occurred in an emulsion stack exposed to a beam of 740-Mev/c antiprotons at the Bevatron. A microphotograph of the antiproton star with the hyperfragment is shown. Properties of the hyperfragment are described. (A.C.)

17198

ELECTRIC POLARIZABILITY OF THE NEUTRON. L. L. Foldy (Case Inst. of Tech., Cleveland). Phys. Rev. Letters 3, 105(1959) July 15.

The electric polarizability of the neutron can presumably be calculated when one has sufficient knowledge of neutron structure, in particular its mesonic structure. Estimates of the polarizability based on current meson theory or on photomeson production data suggest a value lying between 4×10^{-43} cm^3 and 2×10^{-42} cm^3, while currently available experiments place an upper limit of about 10^{-41} cm^3 on its value. (A.C.)

17199

PROTON POLARIZATION IN MULTIPLE PION PRODUCTION AS A CONSEQUENCE OF THE ISOBAR MODEL. L. F. Landovitz and L. Marshall (Brookhaven National Lab., Upton, N. Y.). Phys. Rev. Letters 3, 106-7(1959) July 15.

The isobar model for the system $p + \pi^+$ is in reasonable accord with the gross features of the momentum distribution for pions emitted in proton-proton collisions, and also in pion photoproduction from nucleons. Some consequences which follow for near-threshold production of the isobar by pions if the model is taken seriously are shown. (A.C.)

17200

POSSIBLE METHODS FOR THE DETERMINATION OF STRANGE-PARTICLE PARITIES. A. Sirlin and R. Spitzer (Columbia Univ., New York). Phys. Rev. Letters 3, 110-11(1959) July 15.

Two possible experiments are pointed out that may shed light on the intrinsic parities of strange particles. Consider the capture reaction $K^- + d \rightarrow Y + N$. It has been suggested that the capture of K^- in liquid hydrogen and deuterium occurs mostly from bound s states. Considering this as a working hypothesis, a theorem is derived that may be used to obtain information regarding the parity of the K meson relative to the YN system. (A.C.)

17201

ELECTROMAGNETIC TRANSITIONS BETWEEN μ MESON AND ELECTRON. S. Weinberg (Columbia Univ., New York) and G. Feinberg (Brookhaven National Lab., Upton, N. Y.). Phys. Rev. Letters 3, 111-14(1959) July 15.

The existence of the ordinary μ decay, $\mu \rightarrow e + \nu + \bar{\nu}$, seems to prove that the muon and electron do not differ in any quantum numbers. It follows that weak electromagnetic transitions between muons and electrons could occur, if there is a mechanism to produce them. The purpose of this effort is to discuss phenomenologically (without attachment to any specific mechanism) other kinds of electromagnetic transitions between muon and electron that may be possible even if $\mu \rightarrow e + \gamma$ is somewhat suppressed. (A.C.)

17202

QUANTUM STATISTICS OF INTERACTING PARTICLES. II. CLUSTER INTEGRAL DEVELOPMENT OF TRANSPORT COEFFICIENTS. Elliott W. Montroll and John C. Ward (Univ. of Maryland, College Park). Physica 25, 423-43(1959) June.

A systematic cluster integral expansion was developed for time relaxed pair distribution functions. Each cluster integral can be represented by a Feynman type diagram in $(r, \beta + it\hbar^{-1})$ space. By employing a formalism due to Kubo such distribution functions are used to obtain cluster integral developments of transport coefficients. The transport coefficients are time integrals over time relaxed momentum correlation functions. Since the time integral of each cluster integral diverges, one must sum various sets of cluster integrals before integration. It is shown that in the classical limit summation over one particular set of integrals is equivalent to solving the Boltzmann equation. Irreversibility enters naturally into the formalism through the introduction of grand canonical ensemble averages and passage to the limit as the number of particles and volume become infinite in such a way the N/V preserves the proper value for the density. (auth)

17203

RECOILLESS STRONG COUPLING CHARGED NUCLEON'S PROPAGATOR. L. M. Garrido (Junta de Energía Nuclear, Madrid). Physica 25, 472(1959) June.

Schwinger defined the particle propagators without recurring to expansions in powers of the coupling constant by means of functional equations that contain external sources. A general solution for such equations when the coupling is considered as strong has not been given. A method is presented that yields the recoilless, no closed loops, nucleon's propagator in the strong coupling approximation as a function of the external field. (A.C.)

17204

PHOTO-MESONS FROM POLARIZED NUCLEONS. Alladi Ramakrishnan, S. K. Srinivasan, N. R. Ranganathan, and K. Venkatesan (Univ. of Madras). Proc. Indian Acad. Sci., Sec. A 49, 302-5(1959) May.

It is shown that the angular distribution of photomesons obtained from polarized nucleons behaves differently for left and right circularly polarized beams. (auth)

17205

THE ELASTIC SCATTERING OF 98 Mev NEGATIVE PIONS BY HYDROGEN. D. N. Edwards, S. G. F. Frank, and J. R. Holt (Univ. of Liverpool). Proc. Phys. Soc. (London) 73, 856-68(1959) June.

The elastic scattering by hydrogen of negative pions with mean energy 98 Mev has been measured at 13 angles between 30 and 150° (lab). The pion beam was monitored with a calibrated ionization chamber and its muon and electron contamination determined by means of a Cherenkov counter. This counter was also used in the scattering telescope to separate out the electrons produced by charge exchange γ radiation. The results were corrected for Coulomb effects and a 3-parameter curve fitted to the nuclear parts. The curve is $d\sigma/d\Omega = (1 \pm 0.027)\,[0.385 \pm 0.008 + (0.276 \pm 0.015)\cos\theta + (0.282 \pm 0.031)\cos^2\theta]$. Thus the forward scattering intensity is 0.942 ± 0.043 mb·sterad^{-1}. In a separate transmission experiment the total nuclear cross section for scattering of 98-Mev negative pions by hydrogen was found to be 21.9 ± 0.7 mb. These two figures yield a value for the real part of the forward scattering amplitude $D_- = 0.195 \pm 0.006$ in units $\hbar/m_\pi c$. The corresponding value of f^2 from the dispersion relation is 0.073. (auth)

17206

ON THE MEASUREMENT OF π^+ MESON PHOTOPRODUCTION FROM HYDROGEN NEAR THRESHOLD. G. M. Lewis and R. E. Azuma (University, Glasgow). Proc. Phys. Soc. (London) 73, 873-80(1959) June.

A new counter method has been developed for measuring π^+ meson photoproduction near threshold. It has been employed, in particular, to examine the variation with energy of the differential cross section from hydrogen, at laboratory angles of 115 and 90° to the gamma-ray beam of the Glasgow synchrotron. Polythene and carbon targets were used. Results are compared with theory, and an assessment can be made of the matrix element in the gamma-ray range 165 to 190 Mev. Values of absolute cross section at various energies were also obtained, e.g., for an angle of 90° and a gamma-ray energy of 170 Mev, the absolute differential cross section in center-of-mass coördinates is $(0.48 \pm 0.11) \times 10^{-29}$ cm^2 per steradian. The measurements also confirm the generally accepted value of the π^+ meson lifetime. (auth)

17207

ON IONIC REACTIONS OF NEGATIVE μ-MESONS. P. G. Burke, F. Haas, and I. C. Percival (University College, London). Proc. Phys. Soc. (London) 73, 912-23(1959) June.

The threshold rate coefficient for the μ- exchange process $p\mu + d^+ \rightarrow d\mu + p^+$ is calculated taking into account the effects of strong coupling and of reduced masses. The result is smaller by a factor of about 100 than weak coupling approximations, but is still consistent with experiment. (auth)

17208

SEARCH FOR THE PROCESS $\mu^+ \rightarrow e^+ + \gamma$. T. W. O'Keeffe, M. Rigby, and J. R. Wormald (Univ. of Liverpool). Proc. Phys. Soc. (London) 73, 951-3(1959) June.

The spectrum of positrons emitted by positive muons decaying at rest, in coincidence with a γ-ray photon at 180°, was examined in search of the decay $\mu^+ \rightarrow e^+ + \gamma$. No evidence for the existence of this decay mode was found. An upper limit to the branching ratio ($\mu^+ \rightarrow e^+ + \gamma$ vs. $\mu^+ \rightarrow e^+ + \nu + \bar{\nu}$) is 7.5×10^{-6}. (L.T.W.)

17209

RADIATION OF CHARGED PARTICLES DURING THEIR TRANSIT NEAR IDEALLY CONDUCTING BODIES. Yu. N. Dnestroviskii and D. P. Kostomarov. Radiotekh. i Elektron. 4, 303-12(1959).

Analytical expressions are derived for the radiation of charged particles during their passage near ideally conducting bodies. The expressions obtained can be used to investigate the radiation of the charges which enter a circular waveguide fitted with an infinitely large flange. (J.S.R.)

17210

CONSERVATION OF COMBINED PARITY AS PRINCIPLE LAW OF SYMMETRY IN NATURE. V. G. Solov'ev. Uspekhi Fiz. Nauk 68, 159-63(1959) May. (In Russian)

The law of conservation of combined parity reflects the fundamental properties of space-time. The conservation of parity in separate interactions is the result of additional requirements of invariance. The experimental discovery of the nonconservation of parity in strong interactions described by Lagrangians, referring to the second class, confirms the above concept and leads to a better understanding of nature's phenomena. For instance the nonconservation of parity in meson scattering by nucleons indicates the disarrangement of the charge invariance hypothesis and the appearance of nonlocal interactions. The appearance of nonconservation of parity in nucleon–nucleon interactions permits evaluation of K meson–hyperon force contributions. (R.V.J.)

Heat Transfer and Fluid Flow

17211 AD-208040

Purdue Univ., Lafayette, Ind.

A REVIEW OF THE PUBLISHED LITERATURE PERTAINING TO THE ANNULAR, TWO-PHASE FLOW OF LIQUID AND GASEOUS MEDIA IN A PIPE. D. A. Charvonia. Dec. 1958. 151p. Contract Nonr1858(25). (PUR-32-R).

A literature study on two-phase flow was conducted with the emphasis on annular flow patterns of gas–liquid systems in a pipe. The theoretical and semi-empirical analysis of two-phase flow by various investigators is reviewed, and it is pointed out that analytical methods are generally characterized by procedures such as analysis of the internal mechanics of the liquid film and analysis of the interfacial structure of the flow. Experimental investigations are reviewed, and data pertinent to the annular flow pattern in two-phase flow are emphasized. Experimental results of pressure drop experiments are compared as well as data on liquid film thickness. A discussion of the stability of annular two-phase flow is also presented. 55 references. (J.R.D.)

17212 HW-60564

General Electric Co. Hanford Atomic Products Operation, Richland, Wash.

REACTOR HEAT TRANSFER BY BOILING MERCURY-204. C. A. Rohrmann. June 1, 1959. 29p. Contract W-31-109-Eng-52. $4.80(ph), $2.70(mf) OTS.

This report is a revised version of HW-56161.

In order to emphasize the advantages of boiling Hg^{204} as a reactor coolant, a liquid metal slurry fueled thermal reactor concept is studied in detail. (J.E.D.)

17213 OSR-TN-56-38

Maryland. Univ., College Park. Inst. for Fluid Dynamics and Applied Mathematics.

A METHOD FOR THE MEASUREMENT OF THE FLOW OF AIR BY MEANS OF SERIES OF ELECTRIC SPARKS. H. J. Bomelburg. Feb. 1955. 43p. Contract AF18(600)-893. (BN-68; AD-80549).

A technique has been developed in which series of electric sparks of low current are used to render visible the flow of air. Sparks traversing the air at very high frequency render visible successive displacement profiles; their photographic records furnish a large amount of detailed information. The method is applicable to both subsonic and supersonic flow. The technique has been investigated in detail. Its merits and limitations are appraised as compared with other methods. Numerous photographs are presented to illustrate possible applications. Recommendations are made for the further improvement of the method. (auth)

17214 CEA-tr-A-517

NOUVELLES ÉTUDES DES PHÉNOMÈNES DE TRANSMISSION DE CHALEUR OBSERVÉS DARS L'EAU; CONTRIBUTION AU PROBLÈME DES RÉACTEURS À REFROIDISSEMENT PAR EAU. (New Studies of the Phenomenon of Heat Transfer Observed in Water: Contribution to the Problem of Reactors Cooled by Water.) Gunther Grass. Translated into French from Atomkernenergie 3, 175-82(1958). 29p.

This paper was previously abstracted from the original language and appears in NSA, Vol. 12, as abstract No. 9789.

17215 NP-tr-239

PHYSICAL PROCESSES IN DIFFUSION AND EJECTOR PUMPS. IV. A METHOD OF PRESSURE MEASUREMENT IN SUPERSONIC VAPOUR FLOW AT LOW PRESSURES, ITS RESULTS AND COMPARISON WITH FLOW DIAGRAMS. Horst Kutscher. Translated by A. H. Turnbull (U.K.A.E.A., Atomic Energy Research Establishment) from Z. angew. Phys. 7, 234-40(1955). 15p. $3.30(ph), $2.40(mf) JCL. (Figures omitted; handwritten MS. copy).

A probe is described which allows for pressure and velocity measurements on the center line of an axisymmetrical oil vapor stream at supersonic velocity. These measurements are useful for verifying the model of the streaming process obtained by gas-dynamics calculations and by direct observation of streaming. The validity of gas dynamics in the pressure region under consideration is also examined. The measurements show agreement with theoretical predictions. (J.R.D.)

17216

MASS TRANSFER AT LOW FLOW RATES IN A PACKED COLUMN. V. P. Dorweiler and R. W. Fahien (Iowa State Coll., Ames). A.I.Ch.E. Journal 5, 139-144 (1959) June.

Mass transfer in packed columns has been investigated for a variety of column and packing sizes but at flow rates restricted to fully developed turbulent conditions. The present work was undertaken to investigate mass transfer at flow-rate conditions in the transition

and laminar regions. A dual treatment of experimental data required a knowledge of the variation of concentration and velocity with radial position. A tracer-injection technique was employed which consisted in the introduction of a tracer gas into the center of a bulk gas stream and the measurement of the tracer-gas concentration at various radial positions downstream. The velocity distribution for the packed column was determined by means of a five-loop, circular, hot-wire anemometer. The test column was a vertical 4-in. pipe, packed with ¼-in. spherical, ceramic catalyst-support pellets. Mass transfer diffusivity and Peclet number were determined from two solutions of the differential-diffusion equation applied in previous investigations. An analytical solution in terms of Bessel functions was used to calculate values of average diffusivity and Peclet number and a seminumerical solution in terms of homogeneous linear-difference equations to calculate values of point diffusivity and Peclet number. Variation of diffusivity and Peclet number with radial position is shown, average diffusivity and Peclet number being correlated with Reynolds number. The interaction of molecular and eddy mass transfer mechanisms with decreasing mass velocity is illustrated by defining a molecular and an eddy Peclet number and correlating with Reynolds number. Eddy diffusivity is correlated as a function of local flow conditions. (auth)

17217

HEAT TRANSFER COEFFICIENTS FOR FINNED EXCHANGERS. Abraham Lapin and W. Fred Schurig (Polytechnic Inst. of Brooklyn, N. Y.). Ind. Eng. Chem. 51, 941-4(1959) Aug.

The effect of the number of staggered rows on the mean outside heat transfer coefficient for air flowing across extended surface tubes (finned tubes) has been determined experimentally. When the heat transfer coefficient is reported as a function of the Reynolds number, both the power to which the Reynolds number is raised and the constant of proportionality vary with the number of rows. A general correlation has been developed relating the outside heat transfer coefficient, the Reynolds number, and the number of rows. The maximum deviation from this equation is 35%, with an average deviation of ±4.5%. Curves, tables, and equations are given for design purposes. (C.J.G.)

Nuclear Properties and Reactions

17218 AFSWP-524

Armed Forces Special Weapons Project, Washington, D. C.

GAMMA SPECTRA OF URANIUM-235 FISSION PRODUCTS AT VARIOUS TIMES AFTER FISSION. P. J. Dolan. Mar. 5, 1959. 82p.

Calculated gamma spectra produced by uranium-235 fission are tabulated for various times after fission. Similar tabulations are given omitting certain volatiles and portions of their daughter products. (auth)

17219 NP-7633

Pittsburgh. Univ.

INELASTIC COLLISION CROSS SECTIONS FOR PROTONS AND ATOMIC HYDROGEN ON MOLECULAR HYDROGEN. Technical Report No. 8 [on] CAPTURE-LOSS AND IONIZATION CROSS-SECTIONS OF IONS AND NEUTRAL PARTICLES. Apr. 1959. 43p. Contract Nonr-624(06).

Measurements of the single electron capture cross section, σ_{10}, for protons of energies 2.5 to 60 kev and measurements of single electron capture and loss cross sections for atomic hydrogen, $\sigma_{0\bar{1}}$ and σ_{01}, respectively, over the same energy range are reported. Reported for the first time are measurements of the total cross section for production of ion pairs by hydrogen atoms in molecular hydrogen. A result of the measurements of electron loss by hydrogen atoms is an apparent correlation with H^- formation cross sections for electron impact on molecular hydrogen. (auth)

17220 NYO-8792

Rochester, N. Y. Univ.

VIOLATION OF THE ISOTOPIC SPIN SELECTION RULE IN THE $Ca^{40}(d,\alpha)K^{38}$ REACTION. Y. Hashimoto and W. Parker Alford. May 19, 1959. 22p. Contract AT(30-1)-875. $4.80(ph), $2.70(mf) OTS.

Alpha particles leading to the ground state and first excited state of K^{38} in the $Ca^{40}(d,\alpha)$ reaction were observed, and the excitation energy of the first excited state of K^{38} was determined as 123 ± 8 kev. The relative intensities of the groups were measured for incident deuteron energies between 3.2 and 4.1 Mev. Over this range the average intensity of the ground state group is about 10 times that of the group to the first excited state and it is concluded that the latter is the $O^+T = 1$ analogue of the Ar^{38} ground state. Even in the absence of isotopic spin selection rules, the alpha transition to the O^+ state is expected to be inhibited appreciably by selection rules on angular momentum and parity. A calculation using the statistical model of the nucleus indicates that these decrease the cross section for the $O^+ \rightarrow O^+$ transition by a factor of about 5 relative to that for the ground state transition. It thus appears that the isotopic spin selection rule inhibits the transition only by a factor of about two. This breakdown of the isotopic spin selection rule can probably be attributed to coulomb effects in the component state. The reduction of the cross section as a result of angular momentum selection rule is probably equally important in other (d,α) reactions that have so far been used to study isotopic spin selection rules. It appears that further experimental results are needed for an understanding of the "isotopic spin forbidden" (d,α) reactions on light nuclei. (auth)

17221 UCRL-8772

California. Univ., Berkeley. Lawrence Radiation Lab.

K^- SCATTERING IN DEUTERIUM AT 100 TO 250 Mev/c (thesis). Vincent J. Manara, Jr. May 25, 1959. 47p. Contract W-7405-eng-48. $1.50(OTS).

Submitted to the United States Naval Postgraduate School, Monterey, Calif.

An investigation of K^--meson elastic and inelastic scattering at 100 to 250 Mev/c is reported. Experimentally determined cross sections were compared to theoretical cross sections from the two Dalitz phase-shift solutions for K^--p scattering. Within statistical accuracy, the second Dalitz solution is found to be correct. (auth)

17222

THE PHOTODISINTEGRATION OF TANTALUM. R. W. Parsons and L. Katz (Univ. of Saskatchewan, Saskatoon, Can.). Can. J. Phys. 37, 809-14(1959) July.

The cross section for the absorption of photons by Ta^{181} has been deduced from measurements of the neutrons emitted when tantalum is irradiated in the x-ray beam of a 22-Mev betatron. The cross section has well-defined

peaks at 12.75 ± 0.25 and 15.25 ± 0.25 Mev, and from this the intrinsic electric quadrupole moment is deduced to be 5.7 ± 1.3 barns. (auth)

17223

THE OCCURRENCE OF (n,3n) REACTIONS IN A NUCLEAR REACTOR. T. A. Eastwood and J. C. Roy (Atomic Energy of Canada Ltd., Chalk River, Ont.). Can. J. Phys. 37, 815-26(1959) July.

The reactions $Bi^{209}(n,3n)Bi^{207}$ and $Au^{197}(n,3n)Au^{195}$ have been observed to occur in NRX, a thermal neutron reactor. Competing reactions leading from Bi^{209} or Au^{197} to the same products have been shown to be negligible. Within the uncertainties of the methods used the yields of Bi^{207} and Au^{195} are about those expected on the basis of neutron evaporation from the compound nucleus formed by the amalgamation of the incoming neutron and the target nucleus. Also included is gamma-ray spectra of irradiated bismuth and gold. (auth)

17224

EVIDENCE FOR NEUTRONS WITH AN ENERGY OF 20.3 Mev IN THE NRX REACTOR. J. C. Roy (Atomic Energy of Canada Ltd., Chalk River, Ont.). Can. J. Phys. 37, 827-31(1959) July.

Experimental evidence is presented on the occurrence of the $C^{12}(n,2n)C^{11}$ reaction in the NRX reactor. The probability of occurrence of the competing processes $C^{12}(\gamma,n)C^{11}$ and $C^{12}(p,pn)C^{11}$ is discussed. A comparison is made of the observed reaction rate with the one predicted by the formula representing the energy distribution of the prompt neutrons from the thermal fission of U^{235}. Since the threshold of the $C^{12}(n,2n)C^{11}$ reaction is 20.3 Mev, observation of the reaction in the NRX reactor means that there are neutrons with an energy of at least 20.3 Mev produced in fission. (auth)

17225

THE NEUTRON YIELD FROM HEAVY ICE TARGETS BOMBARDED WITH PROTONS BELOW THE D(p,n)2p THRESHOLD. P. P. Singh, G. M. Griffiths, Y. I. Ssu, and J. B. Warren (Univ. of British Columbia, Vancouver). Can. J. Phys. 37, 866-73(1959) July.

In connection with some experiments on the gamma-ray yield from the $D(p,\gamma)He^3$ reaction using heavy ice targets a considerable yield of neutrons was found even for proton bombarding energies well below the D(p,n)2p threshold of 3.3 Mev. The yield, excitation function, and angular distribution of this neutron yield have been investigated both experimentally and by means of theoretical calculations. These studies confirm the suggestion that the neutrons are produced by a secondary reaction in which deuterons, scattered in the target by incident protons, collide with further target deuterons to produce $D(d,n)He^3$ reactions. (auth)

17226

FORMATION OF MERCURY ISOTOPES 194, 195, AND 197 BY PROTON REACTIONS ON GOLD AT 155 Mev. Nina Poffé, Michel Riou, and Jean Teillac. Compt. rend. 248, 3552-4(1959) June 22. (In French)

The cross sections for the (p,n) and (p,3n) reactions were found to be 31 and 25 mb, respectively, by measuring the Hg^{197} and Au^{195} activities. The activity of Hg^{194} was not observed. The cross section calculated beginning with Au^{194} formed by branching is abnormally low, taking into account a new value for the period of Hg^{194} (about 700 days). (tr-auth)

17227

STUDY OF THE DISINTEGRATION OF ERBIUM-169. G. Charpak and F. Suzor (C.N.R.S., Paris). J. phys. radium 20, 513-15(1959) May. (In French)

By the use of two proportional counters in coincidence and with vacuum-evaporated sources of less than 0.5 $\mu g/cm^2$, the photon and conversion electron spectrum of the 8.4-kev level of Tm^{169}, produced by the decay of Er^{169}, was studied. The branching ratio to the excited level of Tm^{169} was determined as (42 ± 1)%. The internal conversion coefficient was found to be $\alpha_M + \alpha_N = 106 \pm 6$. (tr-auth)

17228

SPALLATION OF TERBIUM BY 170-Mev PROTONS. QUALITATIVE FIRST PART. J. Olkowsky, M. Le Paper, I. Gratot, and L. Cohen (S.R.N.M.E., C.E.N., Saclay, France). J. phys. radium 20, 549-56(1959) May. (In French)

The proton reactions of terbium at 170 Mev were studied by radiochemical methods. The α, β, γ, and x rays were studied for each element and the results compared with data in the literature. A new alpha emitter of gadolinium, half life of 7 hr, was observed with the following gamma rays: 220, 340, 550, and 720 kev. New gamma rays were given for Tb^{155} at 480 and 880 kev, for Eu^{147} at 570 kev, for 38-hr Eu^{146} at 125 and 570 kev, and for Eu^{145} at 180 kev. (auth)

17229

ABSOLUTE CROSS SECTIONS OF THE (γ, n) REACTION FOR Cu^{63}, Zn^{64} AND Ag^{109}. Teruo Nakamura, Kunio Takamatsu, Kiyoji Fukunaga, Minoru Yata, and Shinjiro Yasumi (Univ. of Kyoto). J. Phys. Soc. Japan 14, 693-8(1959) June.

The photonuclear reaction cross section of Cu^{63} (γ, n)Cu^{62} has been frequently used as the standard for the (γ, n) reactions, but measured values by many workers do not agree with one another and can be roughly divided into two groups, namely, about 100 mb group and about 50 mb group. It appears that the former group contains the values obtained mainly from measurements through use of bremsstrahlung, while the latter were obtained mainly with Li(p, γ) gamma rays. Attempts were made to re-determine the (γ, n) cross section for copper, zinc, and silver by Li(p, γ) gamma rays. Absolute measurement of γ quanta was performed by Hough's method, and reaction yields were determined by the activation method in which the absolute numbers of activated nuclei in samples were determined by measuring the β ray with a 4π proportional counter and applying the "method of extrapolation." The cross sections of Cu^{63}, Zn^{64}, and Ag^{109} for 17.6-Mev γ rays were found to be 42.5 mb ± 15%, 23.3 mb ± 18%, and 61.5 mb ± 16%, respectively. Experimental cross sections so far obtained by many workers are compiled, and discussions are given. (auth)

17230

GAMMA RAYS FROM NEUTRON INELASTIC SCATTERING OF MAGNESIUM, ALUMINUM, IRON AND BISMUTH. Masanao Hosoe and Shoji Suzuki (St. Paul's Univ., Tokyo). J. Phys. Soc. Japan 14, 699-707(1959) June.

The gamma rays resulting from the ring scatterers of Mg, Al, Fe, and Bi bombarded with 2.95-Mev neutrons have been investigated. The cross sections for the 0.845-Mev gamma ray from Fe^{56} and for the 1.37-Mev gamma ray from Mg^{24} were 1.10 ± 0.13 and 0.66 ± 0.10 in barns, respectively. The angular distributions of the gamma rays relative to the direction of the incident neutrons were both symmetric around 90°. These

cross sections and angular distributions were compared with the statistical theory by the optical model. The results were fairly well interpreted by using a diffuse potential well. (auth)

17231

ANGULAR DISTRIBUTIONS OF THE REACTION F^{19} (p, α)O^{16} AT 8.0 ~ 14.2 Mev. Hiroshi Ogata (Kyoto Univ.). J. Phys. Soc. Japan 14, 707-13(1959) June.

Alpha particles from the reaction F^{19}(p, α)O^{16}, resulting in the ground state of O^{16}, have been measured, using a proportional counter method. The excitation curve has been measured at a laboratory angle of 50° from 12.9 to 14.1 Mev. The curve changes smoothly with incident proton energy. Angular distributions of the alpha particles have been measured at 14.2, 13.5, 13.0, 12.0, 11.0, 10.0, 9.0, and 8.0 Mev, which can be qualitatively explained by the triton pickup theory. Although fairly good agreements with the theory can be seen at 14.2, 13.5, and 9.0 Mev; the angular distributions for the other energies deviate from the theory to some extent. The deviation is generally larger for backward angles; at 11.0 and 8.0 Mev striking backward peaks are observed. For detailed explanation of the results, refinement of the theory or introduction of other reaction processes or both are required. (auth)

17232

EXCITATION FUNCTIONS AND ANGULAR DISTRIBUTIONS OF THE REACTIONS Al^{27}(p, α)Mg^{24} AT 12.7 ~ 14.1 Mev AND Cr^{52}(p, α)V^{49} AT 9.0 ~ 14.2 Mev. Isao Kumabe, Ching Ling Wang, Maumi Kawashima, Minoru Yada, and Hiroshi Ogata (Kyoto Univ.). J. Phys. Soc. Japan 14, 713-21(1959) June.

By use of a proportional counter, alpha particles were observed from the reactions Al^{27}(p, α)Mg^{24}, resulting in the ground and first excited states of Mg^{24}, and Cr^{52}(p, α)V^{49}, resulting in the lower three and a few higher states. Excitation curves, measured at a laboratory angle of 50° with respect to the bombarding beam, were found to be from 12.7 to 14.1 Mev for Al^{27}(p, α)Mg^{24}, and 9.0 to 14.8 Mev for Cr^{52}(p, α)V^{49}. The former shows a sharp energy dependence, while the latter shows a fairly smooth structure. Angular distributions were measured at 14.1, 13.0 and 12.8 Mev for Al^{27}(p, α)Mg^{24}, and at 14.2, 13.0, 12.0, 11.0, 10.0, 9.5, and 9.0 Mev for Cr^{52}(p, α)V^{49}. Although the Al^{27}(p, α_0)Mg^{24} data can be partially fitted by $[j_2(Qr_0)]^2$ of Butler's theory, some angular distributions show strong backward peaking. Interference between various direct interaction processes or between direct interaction and compound nuclear processes, or both, are responsible for this reaction. The approximate 90° symmetry of Cr^{52}(p, α)V^{49} angular distribution appears to be consistent with the statistical theory of nuclear reactions. The conspicuous forward peak at higher energies, especially at 14.2 Mev, indicates the increasing contribution of direct interaction processes. (auth)

17233

INTERPRETATION OF RESONANCE ENERGIES IN THE PHOTOPRODUCTION AND SCATTERING OF PIONS FROM HYDROGEN. K. M. Guggenheimer (Univ. of Glasgow). Nature 183, 1758-9(1959) June 20.

An attempt is made to give a numerical interpretation of the observed excitation energies in the scattering and photoproduction of pions from hydrogen. (C.H.)

17234

A STATISTICAL ANALYSIS OF EXCITED NUCLEAR STATES. Torleif Ericson. (Inst. for Teoretish Atomfysik, Copenhagen). Nuclear Phys. 11, 481-91 (1959). June (1).

The many known excited states of some medium-weight nuclides are analyzed in terms of the total number of states as a function of the excitation energy. Low-energy nuclear temperatures can be determined and are found to agree well with those obtained from evaporation spectra. There is a marked odd-even difference in the number of states of odd and even nuclei, appearing as a displacement of the curves with respect to each other by the pairing energy. Information on the spin distribution among the excited states is obtained and is related to a nuclear moment of inertia. The theoretical interpretation of the odd-even effect and a constant temperature is discussed in terms of an energy-gap model. (auth)

17235

THE BETA DECAY OF K^{40}. W. H. Kelly, G. B. Beard, and R. A. Peters (Michigan State Univ., East Lansing). Nuclear Phys. 11, 492-8(1959) June (1).

The beta decay of K^{40} was studied using a 1 inch diameter × 1 inch high KI(Tl) scintillation crystal. The Curie plot of the beta spectrum was made linear down to less than 200 kev by the use of the exact third forbidden correction factor. The uncertainty in the correction for electron escape is suggested as the main source of nonlinearity below this energy. The extrapolated end point energy was 1.35 ± 0.02 Mev. A specific activity of 27.2 ± 0.5 betas per second per g of natural potassium was obtained. This corresponds to a decay constant $\lambda(\beta) = (4.72 \pm 0.09) \times 10^{-10} y^{-1}$ and a half-life $t(\beta) = (1.47 \pm 0.03) \times 10^{9} y$. (auth)

17236

A SUGGESTED EXPLANATION FOR THE ANOMALOUS ANISOTROPIES IN HIGH ENERGY FISSION. I. Halpern (Univ. of Washington, Seattle). Nuclear Phys. 11, 522-30(1959) June (1).

Recent experiments on fission induced by high-energy protons show that the angular distributions of fragments are peaked at right angles to the beam. The fission fragments thus come off mainly with orbital angular momenta oriented along the beam axis despite the fact that the angular momenta of the incident protons with respect to the nuclear center are oriented perpendicular to this direction. This "anomaly" is attributed to the cooperation of two effects: (1) There are relatively many collisions of an incident proton with individual nucleons in a nucleus which result in angular momentum transfers to the nucleus along the beam axis. This is due to the nature of the nucleon-nucleon differential cross-section at high energy. (2) The collisions just described generally leave relatively small amounts of excitation energy in the nucleus. It is shown that small excitation energies are particularly favorable for the production of large anisotropies. (auth)

17237

ANGULAR CORRELATION MEASUREMENTS ON Cs^{133} AND THE MAGNETIC MOMENT OF THE 81 kev-LEVEL. E. Bodenstedt, H. J. Körner, and E. Matthias (Physikalisches Staatsinstitut, Hamburg). Nuclear Phys. 11, 584-98(1959) June (1).

The directional correlation of the 355 kev−81 kev $\gamma-\gamma$-cascade was measured as $W(\theta) = 1 + (0.042 \pm 0.005) P_2(\cos\theta) - (0.004 \pm 0.007) P_4(\cos\theta)$. The determination of the anisotropy as a function of the time

delay between the two gamma rays showed no measurable perturbations by internal fields. The directional correlation of the 276 kev−160 kev $\gamma-\gamma$-cascade is found as $W(\theta) = 1 - (0.442 \pm 0.009)\, P_2(\cos\theta) - (0.040 \pm 0.012)\, P_4(\cos\theta)$. The angular correlation data are in agreement with the proposed spin and parity assignments for the 81 kev-level and the 436 kev-level and yield $^5/_2$+ for the 160 kev-level as the most probable value. A reinvestigation of the half life of the 81 kev-level confirmed the known value. The result is $T_{½} = (6.31 \pm 0.05) \times 10^{-9}$ sec. Upper limits for the half lives of the 160 kev-level and the 436 kev-level are $T_{½}$(160 kev) $\leqq 5 \times 10^{-10}$ sec and $T_{½}$(436 kev) $\leqq 1.5 \times 10^{-9}$ sec. The gyromagnetic ratio of the 81 kev-level was obtained by two different methods: a) The rotation and attenuation of the directional correlation pattern of the 355 kev-81 kev $\gamma-\gamma$-cascade is observed in a constant external magnetic field. b) The anisotropy of the same directional correlation is measured as a function of the external magnetic field. The result is $g = +1.23 \pm 0.12$, which yields a magnetic moment $\mu = 3.1 \pm 0.3$ nuclear magnetons. A lower limit for the gyromagnetic ratio of the 160 kev-level can be given: $g \geqq +0.25$. This result was obtained by observing the rotation of the 276 kev−160 kev directional correlation in an external magnetic field of 24,200 gauss. This field yields a rotation $\omega_L \cdot \tau = 1.20° \pm 0.35°$ (ω_L = Larmor frequency, τ = mean life of the 160 kev-level. (auth)

17238

MUON CAPTURE IN CERTAIN LIGHT NUCLEI. A. Fujii (Purdue Univ., Lafayette, Ind.) and H. Primakoff (Washington Univ., St. Louis, Mo.). Nuovo cimento (10) 12, 327-55(1959) May 16.

The rates of the muon capture reactions $\mu^- + {}^3He \rightarrow {}^3H + \nu$, $\mu^- + {}^6Li \rightarrow {}^6He + \nu$, and $\mu^- + {}^{12}C \rightarrow {}^{12}B + \nu$, with the daughter nuclei formed in their ground states, are calculated assuming universality between muon-bare nucleon and electron-bare nucleon coupling constants. The induced pseudoscalar interaction and the additional terms arising from the assumption of a conserved vector current are included in the muon-nucleon effective Hamiltonian. The ratios of the nuclear matrix elements for the muon captures and for the corresponding β decays are first estimated in an approximately model independent fashion using appropriate nuclear proton density distribution functions and then evaluated in more detail on the basis of variational trial wave functions for ^{3}He, ^{3}H, and of LS coupling and jj coupling shell model wave functions (with configuration mixing) for ^{6}Li, ^{6}He, and ^{12}C, ^{12}B, respectively. The calculated capture rate for $\mu^- + {}^{12}C \rightarrow {}^{12}B + \nu$ is in agreement with experiment. (auth)

17239

LIFETIME OF THE 186-kev LEVEL OF THORIUM-231. D. Strominger (California. Univ., Berkeley. Radiation Lab.). Phys. Rev. 114, 502-4(1959) Apr. 15.

The lifetime of the 186-kev level of Th^{231} has been studied following U^{235} alpha decay. The half-life value of this level is 0.77 ± 0.12 mμsec. (auth)

17240

SEARCH FOR RESONANCE STRUCTURE OF NEUTRON CROSS SECTIONS AT 100 Mev. Stuart G. Carpenter and Richard Wilson (Harvard Univ., Cambridge, Mass.). Phys. Rev. 114, 510-13(1959) Apr. 15.

Searches were conducted for resonances in neutron cross sections near 100 Mev by a self-absorption method. A sign barely significant, was found of resonance structure in antimony or cadmium, but if the resonance cross section is 1.2 times the nonresonant cross section, the resonances are present over only 3% of the energy band. The upper limit for the other elements is 1%. Differences of neutron total cross sections for several adjacent elements were measured precisely, and it was found that there are many deviations from a smooth curve as a function of $A^{⅓}$. (auth)

17241

REACTION MECHANISM IN INELASTIC SCATTERING OF PROTONS FROM Mg, Cr, AND OTHER ELEMENTS FROM 3.5 TO 7 Mev. Frederick D. Seward (Univ. of Rochester, N. Y.). Phys. Rev. 114, 514-25(1959) Apr. 15.

Inelastic scattering of protons leading to the first excited states of Mg^{24} and Cr^{52} and to single excited states of other elements has been studied. $d\sigma/d\omega$ (90°) was measured as a function of proton energy from 3.5 to 7 Mev. Angular distributions of inelastically scattered protons and $p'-\gamma$ angular correlations were taken at several energies. Experimental measurements are compared with direct-interaction theory and with predictions of the statistical model. Data for $Cr^{52}(p,p')Cr^{52*}$ at 5.4 Mev is well fit by the statistical model. The $Mg^{24}(p,p')Mg^{24*}$ reaction at 7 Mev can be interpreted as a direct interaction. The Mg reaction at 5.4 Mev and the Cr reaction at 7 Mev appear to have a bit of direct interaction in them. It is suggested that the amount of direct interaction in this (p,p') reaction depends on the nuclear barrier height. Statistical-model expressions for reactions studied are given in an Appendix. (auth)

17242

ELASTIC SCATTERING OF 40-Mev PROTONS FROM ISOTOPES OF Fe, Ni, AND Cu. Morton K. Brussel and John H. Williams (Univ. of Minnesota, Minneapolis) Phys. Rev. 114, 525-33(1959) Apr. 15.

Protons of 39.8 Mev were scattered from thin targets of Fe^{54}, Fe^{56}, Ni^{58}, Ni^{60}, and Cu^{65}. Absolute differential cross sections obtained with a statistical accuracy of ≦3% have been determined for the elastically scattered protons. The range of the angular distributions, 7.5° to 110°, encompassed three minima and three maxima in the measured cross sections. The energy resolution of the detection equipment, utilizing a NaI(Tl) crystal, was 1.2-2%. This enabled a separation to be made of elastic from nonelastic events. A detector telescope allowed angular resolutions of ± ⅛° to be used in determining the shape of the features in the angular distributions. The general variation of the cross sections with the nuclear mass is noted. In addition, the data suggest that the nucleon shell closing about nucleon number 28 introduces fine structure differences in the shape and magnitude of features of the scattering pattern. (auth)

17243

STUDY OF (d,α) REACTIONS ON SOME LIGHT NUCLEI. G. E. Fischer and V. K. Fischer (Columbia Univ., New York and Brookhaven National Lab., Upton, N. Y.). Phys. Rev. 114, 533-9(1959) Apr. 15.

The angular distributions of the charged particles from the $N^{14}(d,d)N^{14}$, $N^{14}(d,\alpha_0)C^{12}$, $N^{14}(d,\alpha_1)C^{12*}$, and $N^{15}(d,\alpha_0)C^{13}$ reactions have been studied with a deuteron bombarding energy of 21 Mev. The charged-particle groups are identified, and their energy is measured by a dE/dX vs. E counter telescope. The N(d,α)C angular distributions and the $O^{16}(d,\alpha)N^{14}$ angular distribution

measured by Freemantle et al. have been compared with theoretical curves calculated from a simplified direct-interaction model. The relative magnitudes of the experimentally determined cross sections have also been compared with theory. The results indicate that the $O^{16}(d,\alpha_0)$ reaction can be described by the compound-nucleus extreme, while the $N^{14}(d,\alpha_1)$ process appears to favor description by a direct-interaction model. The remaining (d,α) reactions are intermediate cases. (auth)

17244

EVIDENCE FOR THREE-BODY VECTOR FORCES IN LIGHT NUCLEI. Arnold M. Feingold (Univ. of Utah, Salt Lake City). Phys. Rev. 114, 540-9(1959) Apr. 15.

The splittings of the P-doublet states of Li^7 and N^{15}, and the D-doublet states of O^{17}, are calculated with phenomenological two-body vector forces of both Gaussian and Yukawa shapes with arbitrary ranges and exchange character. It is found to be impossible to fit the experimental data with a two-body force of fixed strength, in agreement with Pearse's calculations based on a relativistic two-body vector force. The splittings are then calculated with a phenomenological three-body vector force of the type expected to arise from higher order effects of the tensor force. The predicted ratio of the P doublet splitting in N^{15} to that in Li^7 is found to be quite insensitive to the range or shape of the three-body force, and in excellent agreement with experiment, provided that the exchange character of the force is not chosen close to the Serber mixture. The O^{17} D-doublet splitting, while somewhat more sensitive to the choice of range and exchange mixture, can also be fitted simultaneously, with a wide variety of three-body vector potentials. An attempt is then made to derive the parameters of the three-body vector force from the Gammel-Thaler tensor force parameters, but the resultant force has the wrong exchange character, and is also much too weak, to fit the experimental data. This is mainly due to the Serber-like exchange character of the Gammel-Thaler tensor force. A moderate increase in the strength or range of the odd-state tensor force would give a satisfactory three-body vector force. The splitting of the ^3D states of Li^6 is also examined. Here one-, two-, and three-body vector forces all predict too small a splitting, when the strength of the interaction is normalized to the Li^7 P-doublet splitting. For the three-body vector force, however, there exists the possibility that the strength parameter is greater for Li^6 than for Li^7, which would improve the fitting. (auth)

17245

PROTON-PROTON SCATTERING FROM 1.4 TO 2.4 Mev. David J. Knecht, S. Messelt, E. D. Berners, and L. C. Northcliffe (Univ. of Wisconsin, Madison). Phys. Rev. 114, 550-9(1959) Apr. 15.

Differential cross sections for the scattering of protons by protons have been measured at energies of 1.397, 1.855, and 2.425 Mev over an angular range from 12° to 90° in the center-of-mass system. Total uncertainties vary from about ±0.1% at large angles to ±0.3% at the smallest angles. A thorough investigation of sources of error has yielded cross-section values in disagreement with previously published values. A simple phase-shift analysis has been made. Without the inclusion of vacuum polarization contributions, a satisfactory fit is not obtained with only S-wave and effective nuclear P-wave phase shifts. With their inclusion, the data are fitted well by pure S-wave nuclear scattering. An upper limit on the magnitude of the effective nuclear P-wave phase shift is estimated at about 0.02° at these energies. (auth)

17246

EVIDENCE FOR DIRECT INTERACTIONS AT LOW ENERGY. H. A. Lackner, G. F. Dell, and H. J. Hausman (Ohio State Univ., Columbus). Phys. Rev 114, 560-5(1959) Apr. 15.

The angular distributions of protons corresponding to the first excited-state transition in the reaction $Mg^{24}(p,p')_{1.38\,Mev}$ have been measured for bombarding energies between 5.0 and 6.2 Mev. The angular correlations between the gamma rays emitted from the first excited state of Mg^{24} and the inelastically scattered protons have been measured at two different bombarding energies and for three proton detection directions. The angular correlation data are fitted to curves of the form $A + B \sin^2[2(\theta-\theta_q)]$, where θ_q is the momentum transfer direction for the reaction. The angular correlation data are consistent with predictions of the direct-interaction theory. (auth)

17247

EXCITATION FUNCTION OF THE REACTION $Zn^{64}(n,p)Cu^{64}$ WITH NEUTRONS OF ENERGIES BETWEEN 2 AND 3.6 Mev. J. Rapaport and J. J. van Loef (Universidad de Chile, Santiago). Phys. Rev. 114, 565-9(1959) Apr. 15.

The relative cross section for $Zn^{64}(n,p)Cu^{64}$ has been measured by an activation method for neutron energies of 2.0 to 3.6 Mev. The absolute cross section at 3.55-Mev neutron energy is found to be 56.4 ± 9.0 mb by comparing the Cu^{64} positron activity with the amount of Si^{31} formed in the $P^{31}(n,p)Si^{31}$ reaction, which has a previously known cross section of 96.2 ± 9.0 mb. The cross section rises monotonically with increasing energy from a value of 12 mb at 2.0 Mev. The experimental results are compared with the predictions of statistical theory; experimental level densities are used in the calculations, but even so the predicted yield is too small. An upper limit of 2 mb is assigned to the cross section for $Zn^{68}(n,\gamma)Zn^{69*}$ at 3 Mev. (auth)

17248

515-kev AND 679-kev RESONANCES IN THE REACTION $Na^{23}(p,\gamma)Mg^{24}$. Lennart Simons (Univ. of Helsinki). Phys. Rev. 114, 569-70(1959) Apr. 15.

The 515-kev and 679-kev resonance levels have previously been assigned $J = 1^+$ and $J = 3^+$, respectively, the latter being formed by LS coupling. An alternative assignment is presented in this paper, according to which the 515-kev level has $J = 2^-$ formed by jj coupling with $j_p = \frac{1}{2}^-$ or $j_p = \frac{3}{2}^-$. $J = 3^+$ is confirmed for the 679-kev resonance level, assuming jj coupling with $j_p = \frac{3}{2}^+$. (auth)

17249

TOTAL NEUTRON YIELDS FROM LIGHT ELEMENTS UNDER PROTON AND ALPHA BOMBARDMENT. J. H. Gibbons and R. L. Macklin (Oak Ridge National Lab., Tenn.). Phys. Rev. 114, 571-80(1959) Apr. 15.

Total neutron production cross sections have been measured for targets of D, T, Li^7, Be^9, B^{11}, C^{13}, C^{14}, and F^{19} under proton bombardment and of Li^7, Be^9, B^{10}, and Si^{29} under alpha-particle bombardment. Energy ranges covered differ, but were contained between threshold and 5 Mev for protons and between threshold and 9 Mev for alphas. In several cases cross sections for the in-

verse reactions, (n,p) and (n,α), have been computed and compared, where available, with direct measurements. (auth)

17250

PROMPT-NEUTRON EMISSION FROM SINGLE FISSION FRAGMENTS. Stanley L. Whetstone, Jr. (Los Alamos Scientific Lab., N. Mex.). Phys. Rev. 114, 581-5(1959) Apr. 15.

With a Cf^{252} source placed at the edge of a large cadmium-loaded liquid scintillator, it has been possible to obtain a measure of the number of prompt neutrons emitted from a single fission fragment of measured mass. The mass determination results from a concurrent time-of-flight measurement of the two fragment velocities. The 30-in. scintillator has a high detection efficiency, little dependent on the energy of the neutrons, and permits detection in a full hemisphere about the direction of one of the fragment flight paths. The average number of neutron counts per fission is found to increase with the mass number of the fragment approaching the neutron detector in much the same way in both the light- and heavy-fragment groups, with a sharp decrease occurring in passing from the light to the heavy group. A correction for the geometry of the neutron detection, assuming isotropic emission of the neutrons in the fragment frames, enhances slightly the sawtooth dependence of $\bar{\nu}(A)$ and gives for the ratio of the average number of neutrons from the light fragment to that from the heavy fragment $\bar{\nu}_L/\bar{\nu}_H = 1.02 \pm 0.02$. One is led to believe that either the emission of the neutrons is far from isotropic or that the slightly lighter fragments possess considerably more excitation energy than the slightly heavier fragments when the mass division is nearly symmetric. Perhaps a new picture of the mass division is indicated. (auth)

17251

RESONANCE SCATTERING OF GAMMA RAYS BY THE 4.46-Mev AND THE 5.03-Mev STATES OF B^{11}. L. Cohen, R. A. Tobin, and J. McElhinney (Naval Research Lab., Washington, D. C.). Phys. Rev. 114, 590-2(1959) Apr. 15.

The continuous x-ray spectrum from the NRL betatron was used to excite and study the 4.46-Mev and the 5.03-Mev states in B^{11}. The self-indication technique that was employed yielded the following values for the resonance integrals: $\sigma_0\Gamma = (0.79 \pm 0.21) \times 10^{-4}$ Mev-barn for the lower state and $(0.98 \pm 0.17) \times 10^{-4}$ Mev-barn for the upper state. (auth)

17252

ANALYSIS OF THE Λ-HYPERNUCLEAR THREE-BODY SYSTEMS. B. W. Downs (Cornell Univ., Ithaca, N. Y.) and R. H. Dalitz (Univ. of Chicago). Phys. Rev. 114, 593-602(1959) Apr. 15.

An analysis of the Λ-hypernuclear three-body systems is made by a variational method with a six-parameter trial function. An upper bound for the strength of the Λ-nucleon interaction required to account for the observed binding of the T = 0 hypertriton $_{\Lambda}H^3$ is obtained. This upper bound is 10–20% (depending upon the value taken for the binding energy) lower than the previous estimate by the same authors. An improved quantitative estimate of the spin dependence of the Λ-nucleon interaction (neglecting the possible influence of three-body forces) is obtained from the results of this analysis and those of a previous analysis of $_{\Lambda}He^5$; from this estimate it follows that the existence of a bound Λ-nucleon system is strongly excluded. The analysis of the T = 1 triplet $_{\Lambda}H^3$, $_{\Lambda}H^3$, $_{\Lambda}n^3$ indicates that these systems are not expected to form bound states. It appears that the essential conclusions of this work would not be seriously affected if there exist moderately strong three-body forces arising from pion exchange processes. (auth)

17253

SEARCH FOR DIRAC MONOPOLES. Hugh Bradner and William M. Isbell (Univ. of California, Berkeley). Phys. Rev. 114, 603-4(1959) Apr. 15.

Nuclear emulsions were used to establish the upper limits for the production of Dirac monopoles by 6.3-Bev protons. If poles of protonic mass are produced by direct nucleon-nucleon collision, the production cross section is less than 2×10^{-35} cm^2 per nucleon. If poles of protonic or lower mass are produced by direct or by secondary processes and are subsequently held in matter with a binding energy less than 3 ev, the production cross section is less than 1.5×10^{-37} cm^2 per nucleon. If poles of protonic or lower mass are produced by direct or by secondary processes and are subsequently held in matter with a binding energy between 3 ev and 20 ev, the production cross section is less than 10^{-40} cm^2 per nucleon. (auth)

17254

ABSORPTION OF μ^- MESONS IN C^{12}. H. V. Argo, F. B. Harrison, H. W. Kruse, and A. D. McGuire (Los Alamos Scientific Lab., N. Mex.). Phys. Rev. 114, 626-33(1959) Apr. 15.

It is known that there is a strong similarity between the electron-nucleon and electron-muon weak interactions. This paper is a report on an experimental investigation of the third leg of the triangle, the muon-nucleon interaction. The absorption of negative cosmic-ray muons stopped in C^{12} was studied, and the probability per second of absorption resulting in the formation of B^{12} in the ground state was measured and found to be 9050 ± 950 sec^{-1}. This is compared to the known rate of β decay of B^{12} to the ground state of C^{12}, 33.2 ± 0.65 sec^{-1}. The ratio of the rates is 273 ± 29. In the allowed approximation, the nuclear matrix elements for the two processes are the same, and the ratio of the rates can be calculated in terms of the ratio of the coupling constants without assuming a nuclear model. The short wavelength of the neutrino emitted in μ absorption (13 fermis) causes forbidden matrix elements to make an important contribution to the μ-absorption rate, so that the theoretical prediction is dependent on the nuclear model. Within the uncertainties of the calculation, the electron-nucleon and muon-nucleon axial vector coupling constants are the same. (auth)

17255

UNNATURAL PARITY STATES IN O^{16}. [PART] I. D. A. Bromley, H. E. Gove, J. A. Kuehner, A. E. Litherland, and E. Almqvist (Atomic Energy of Canada Ltd., Chalk River, Ont.). Phys. Rev. 114, 758-74(1959) May 1.

A detailed study of the de-excitation of gamma emitting states in O^{16} at 8.87, 10.94, and 11.06 Mev has been carried out using the $N^{14}(He^3,p\gamma)O^{16}$ reaction. Branching ratios and angular distribution measurements on both proton groups and gamma radiations strongly suggest assignments 2^-, 0^-, and 3^+, respectively, although in the latter case the 2^- possibility is not excluded. The experimental results are compared with predictions of the alpha-particle and intermediate-coupling shell models.

While considerable areas of agreement exist, serious discrepancies remain in both cases. The identification of the 0^-, 10.94-Mev state precludes Dennison's preferred "identification (a)" in the alpha-particle model and fixes the exchange mixture in the shell model calculations; the O^{16} mixture closely resembles a Serber rather than the Rosenfeld mixture commonly in use in these shell model calculations. From the measured de-excitation branching ratio $\Gamma_\alpha/\Gamma_\gamma$ for the 10.94-Mev state and the systematics of gamma-radiation and alpha-particle transition widths, an upper limit of $\sim 2 \times 10^{-9}$ is obtained for the relative intensity of an opposite-parity component in the wave function of this state. (auth)

17256

UNNATURAL PARITY STATES IN O^{16}. [PART] II. J. A. Kuehner, A. E. Litherland, E. Almqvist, D. A. Bromley, and H. E. Gove (Atomic Energy of Canada Ltd., Chalk River, Ont.). Phys. Rev. 114, 775-85(1959) May 1.

Measurements on both proton and gamma angular distributions and on proton-gamma angular correlations from the $N^{14}(He^3,p\gamma\gamma)O^{16}$ reaction suggest that for an incident energy of 2.1 Mev and target thicknesses corresponding to between 200 and 350 kev for these He^3 ions, the excited states of O^{16} are formed with equally populated magnetic substates. A number of gamma-gamma angular correlations have been studied from this reaction; these support the hypothesis of equal substate populations for the 8.87-, 10.94-, and 11.06-Mev states. On this hypothesis, the quadruple angular correlations studied reduce to effective double gamma-gamma correlations which are amenable to much simpler analysis. Using this hypothesis, gamma-gamma angular correlation data have been used in conjunction with the data on the relative gamma-ray de-excitation probabilities of the excited states of O^{16} to fix the spins and parities of the levels at 8.87, 10.94, and 11.06 Mev as 2^-, 0^-, and 3^+, respectively. In addition the multipole amplitude ratios have been obtained for a number of the transitions involved in the calculations; these are used to calculate M1 inhibition factors expected for $\Delta T = 0$ transitions in self-conjugate nuclei and these in turn are compared with the theoretical estimates for this inhibition. Where intermediate-coupling shell model predictions are available for the multipole mixtures they are also compared with the experimental results; an anomalously low value of the depth of the central potential used in these calculations is required for agreement. (auth)

17257

DEUTERON-PICKUP REACTION IN AN OPTICAL-MODEL APPROXIMATION. Kenneth R. Greider (Univ. of California, Berkeley). Phys. Rev. 114, 786-94(1959) May 1.

A theory of the (p,d) pickup reaction is described in which the nuclear interactions of the incoming and outgoing particles are considered. Two different formal expressions that give the transition amplitude are derived, and the wave functions in this amplitude are approximated by an optical-model procedure in which it is assumed that the initial- and final-state particles scatter elastically in the nucleus. Several closed forms for these optical-model wave functions are derived on the basis of a WKB approximation for a complex square-well scattering potential. The use of these wave functions, along with an approximation that gives the form of the transition amplitude in terms of Gaussian functions, allows a closed-form solution for the differential cross section. It is found that the elastic-scattering processes are not negligible, since they affect considerably the magnitude and the shape of the differential cross section. By comparing the theory with recent pickup experiments on C^{12} at 95 and 145 Mev, one obtains a nuclear-momentum distribution that, unlike the Born approximation analysis, is in good agreement with the results of other determinations of momentum distributions. It is found that a neutron number of from 4 to 6 neutrons and momentum distribution of $\exp(-E/14)$ are required to fit the data. (auth)

17258

DEVIATION FROM THE ξ APPROXIMATION IN FIRST FORBIDDEN β DECAY. Tsuneyuki Kotani (Indiana Univ., Bloomington). Phys. Rev. 114, 795-806(1959) May 1.

The failure of the ξ approximation in which only the first nonvanishing term is kept in the expansion in descending powers of the Coulomb energy factor is due to either the cancellation or selection rule effect. The latter may be due to K or j forbiddennesses. In order to distinguish these three possibilities experimentally, the two transitions, $3(\beta)2(\gamma)0$ and $2(\beta)2(\gamma)0$, are discussed. The present data on Sb^{124} and Rb^{86} are insufficient to permit drawing a definite conclusion. Similar arguments can be extended to other β decays. To get more information, the general energy and angular dependences are given in convenient form for various observables, and are shown numerically for Sb^{124}. Certain β-γ correlation experiments, especially the β-circularly polarized γ correlation and the transverse β polarization, are proposed for a variety of special β decays, e.g., Ga^{72}, Y^{92}, and so on. It is also concluded that the unique shape energy spectrum does not necessarily correspond to a unique forbidden transition. An example is Eu^{152}. Measurements of β-γ correlations are useful in order to decide this correspondence. Other β decays, which may be characterized by the cancellation, are Ag^{111}, Re^{186}, and Tm^{170}. (auth)

17259

$Si^{28}(d,\alpha)Al^{26}$ REACTION. Cornelius P. Browne (Massachusetts Inst. of Tech., Cambridge). Phys. Rev. 114, 807-14(1959) May 1.

Earlier work on the $Si^{28}(d,\alpha)Al^{26}$ reaction was extended and improved. The ground state Q-value of the reaction was remeasured and found to be 1.428 ± 0.004 Mev. Levels were found with excitation energies of (in Mev) 0.229 ± 0.003, 0.418 ± 0.002, 1.060 ± 0.002, 1.762 ± 0.003, 1.853 ± 0.003, 2.073 ± 0.003, 2.368 ± 0.003, 2.548 ± 0.004, 2.663 ± 0.004, 2.741 ± 0.005, 2.916 ± 0.006, 3.075 ± 0.006, 3.160 ± 0.006, 3.407 ± 0.006, 3.510 ± 0.010, and 3.596 ± 0.010. Seven of these have not been reported previously. The yields of the reaction leading to the ground state, the first excited state, and the second excited state were measured as a function of bombarding energy in the range 5.5 Mev to 7.5 Mev. There is strong resonance structure. The angular distributions for the reaction leading to these three states were obtained at 7.03 Mev bombarding energy. At this energy the total yield of the isotopic-spin forbidden reaction leading to the first excited state is 10% of the yield to the ground state. This violation of the selection rule can be explained by Coulomb force effects. The second $T = 1$ level could not be observed and the previous suggestion that the level at 3.16 Mev is the third $T = 1$ level seems to be incorrect. A comparison of the

data with the results of other experiments is made. Energy levels of Al^{27} seen in the $Si^{29}(d,\alpha)Al^{27}$ reaction are listed and compared with results from $Al^{27}(p,p')Al^{27*}$ A new level at 5.745 ± 0.012 Mev was found plus several levels above the range of excitation previously covered. (auth)

17260

INELASTIC SCATTERING OF 21.6-Mev DEUTERONS. J. L. Yntema and B. Zeidman (Argonne National Lab., Lemont, Ill.). Phys. Rev. 114, 815-20(1959) May 1.

The inelastic scattering of 21.6-Mev deuterons by Ni, Cu, Zn, Rh, Ag, Sn, Gd, Ta, Pt, and Au has been measured. A NaI(Tl) crystal sandwich was used for the detection of the scattered particles. The calculated energy scale of the spectrum was checked by observing the inelastic spectrum from Mg. The angular distribution shows a pronounced peaking in the forward direction. At background angles there is no increase in cross section with increasing excitation, showing that compound-nucleus processes do not contribute to the cross section. Up to an excitation of 10 Mev, the inelastic scattering cross section for 21.6-Mev deuterons scattered at 60° by Au is not measurably different from that for 22-Mev protons. However, the inelastic deuteron cross sections for Ni, Cu, and Zn are about half of the corresponding 22-Mev proton cross sections at 60°. The gross structure found by Cohen in the inelastic spectrum is also observed in the present experiment. However, the gross structure in Ta and Gd appears to be considerably more pronounced in the deuteron spectrum than in the proton spectrum. (auth)

17261

ELASTIC SCATTERING OF 21.6-Mev DEUTERONS BY SEPARATED ISOTOPES OF NICKEL AND COPPER. J. L. Yntema (Argonne National Lab., Lemont, Ill.). Phys. Rev. 114, 820-2(1959) May 1.

The relative differential cross sections for the elastic scattering of 21.6-Mev deuterons by Ni^{58}, Ni^{60}, Cu^{63}, and Cu^{65} have been measured. The diffraction pattern shows a shift with atomic number. The shift from Ni^{58} to Ni^{60} is about the same as the one between Cu^{63} and Cu^{65}. The shift between Ni^{60} and Cu^{63} is about 1.5 times that of the others. (auth)

17262

SEARCH FOR THE ISOTOPE Ir^{196}. Donald G. Gardner and W. Wayne Meinke (Univ. of Michigan, Ann Arbor). Phys. Rev. 114, 822-4(1959) May 1.

The isotope Ir^{196} has been reported to have a half life of ~9 days and to emit β^- particles with a maximum energy of about 0.08 Mev. Using deuteron-bombarded enriched isotopes of platinum, it is shown that the previous mass assignment was incorrect. It is suggested that the ~9-day activity found in deuteron bombardments of natural platinum is due to Ir^{189} and Ir^{190} produced by the (d,n) reaction on osmium impurities. An experimental upper limit of 5 hours for the Ir^{196} half-life can be set by these experiments. Rough cross sections for the (d,α) reaction on Pt^{194} and Pt^{196} are given for several deuteron energies from 9.6 to 20.4 Mev. (auth)

17263

LIFETIME OF THE FIRST EXCITED STATE OF K^{40}. F. J. Lynch and R. E. Holland (Argonne National Lab., Lemont, Ill.). Phys. Rev. 114, 825-6(1959) May 1.

The first excited state of K^{40} at 29.4 kev has been produced by using the reaction $Ar^{40}(p,n)K^{40}$. Its mean life, measured by a pulsed-beam technique, is 5.6 ± 0.5 mμsec. (auth)

17264

EXPERIMENTS CONCERNING THE LOW-ENERGY STATES OF THE O^{19} NUCLEUS. W. Zimmermann, Jr. (California Inst. of Tech., Pasadena). Phys. Rev. 114, 837-46(1959) May 1.

Angular distributions have been measured for three groups of protons from the $O^{18}(d,p)O^{19}$ reaction, those leaving O^{19} in its states at 0, 0.096 and 1.47 Mev. Deuteron energies of 1.74 and 2.50 Mev in the laboratory system were used. The distributions of protons leaving O^{19} in its ground state and in its 1.47-Mev state are characteristic of stripping and indicate the formation of the ground state by an $l = 2$ neutron and of the 1.47-Mev state by an $l = 0$ neutron. However, the distribution of protons leaving O^{19} in its 0.096-Mev state does not lend itself to a stripping interpretation. It has been found that the γ decay of the 1.47-Mev state of O^{19}, following the formation of this state in the $O^{18}(d,p)O^{19}$ reaction, proceeds mostly to the 0.096-Mev state. The mean life of the 0.096-Mev state has been measured by observing the decay in flight of recoiling excited O^{19} nuclei and is found to be $1.75(1 \pm 0.16) \times 10^{-9}$ second. These observations restrict the likely assignments of spin and parity for the 0.096-Mev state to $\frac{3}{2}^{\pm}$ or $\frac{5}{2}^{+}$. (auth)

17265

GROSS STRUCTURE IN (d,p) REACTIONS NEAR Z = 50. R. A. Peck, Jr. (Brown Univ., Providence). Phys. Rev. 114, 847-57(1959) May 1.

Proton spectra from $Sn^{120}(d,p)Sn^{121}$ and $In^{115}(d,p)In^{116}$ at 19.7 Mev are presented, covering 6.5 Mev of excitation in the product nucleus and laboratory angles from 15 to 155° at 10° intervals. The reactions are closely similar in all characteristics. Broad energy groups are discussed relative to the correlation with neutron single-particle states anticipated by a giant-resonance interpretation of their nature. Of four such groups identified, the spectral locations of three agree quantitatively with the single-particle level scheme deduced from binding-energy data. A group at 0.8 Mev, while consistent with single-particle gross structure, may represent a distinct nuclear level enhanced for reasons not clear. Angular distributions for the several groups fail to show the strong minima characteristic of pure stripping forms, probably as a consequence of the spreading of single-particle levels resulting from finite nuclear distortion which also weakens the spectral gross structure. However, the slight structure which the distributions do display is qualitatively consistent with stripping peak positions consequent on the single-particle interpretation of the spectra. (auth)

17266

NUCLEAR SPINS OF I^{128} AND I^{130}. J. E. Sherwood and S. J. Ovenshine (Oak Ridge National Lab., Tenn.). Phys. Rev. 114, 858-61(1959) May 1.

The nuclear spins of I^{128} and I^{130} have been measured by means of an atomic beam magnetic resonance apparatus. A value of 1 was obtained for I^{128}, as predicted by Benczer et al. However, a value of 5 was obtained for I^{130}, in disagreement with the expectations of Caird and Mitchell. The nature of the discrepancy is indicated. The apparatus and technique are described, with special attention to the source and detector arrangements. (auth)

17267

LIFETIME OF THE FIRST EXCITED STATE OF Li^7.

C. P. Swann, V. K. Rasmussen, and F. R. Metzger (Franklin Inst., Swarthmore, Penna.). Phys. Rev. 114, 862-6(1959) May 1.

The $Li^7(p,p')Li^{7*}$ reaction was used as the source of Doppler-broadened 478-kev gamma rays to determine the mean life of the first excited state of Li^7 by the nuclear resonance fluorescence technique. Both scattering and self-absorption experiments using both LiF and Li as the scattering and absorbing materials were performed. The resonance scattering gives a mean life of $(1.09 \pm 0.07) \times 10^{-13}$ sec after a 2% correction for slowing down of the Li^{7*} nuclei has been made. This correction follows from the measured stopping cross sections for lithium ions. An additional correction, for the effect of collisions in which the Li^{7*} nuclei lose a large fraction of their energy, is found difficult to estimate, although it is certainly not more than a few percent. For this reason, the scattering measurement is regarded as giving a lower limit for the mean life. The self-absorption measurements give a mean life of $(1.15 \pm 0.14) \times 10^{-13}$ sec. Debye temperatures of 400 and 700°K were used for Li and LiF, respectively. The error given, about twice the statistical error of the data, includes estimates of the effect of other experimental uncertainties. (auth)

17268

LIFETIME OF THE 0.119-Mev STATE OF THE N^{16} NUCLEUS. W. Zimmermann, Jr. (California Inst. of Tech., Pasadena). Phys. Rev. 114, 867-9(1959) May.

The mean life of the 0.119-Mev state of N^{16} has been measured and is found to be $7.83(1 \pm 0.04) \times 10^{-6}$ second. This state was produced by means of the $N^{15}(d,p)N^{16}$ reaction with deuterons having a laboratory energy of 1.76 Mev. The experiment involved periodically directing the deuteron beam onto and then away from the target. The lifetime was determined by measuring the decay rate of the 0.119-Mev γ-ray activity during the periods when the beam was off the target. (auth)

17269

ILLUSTRATION OF THE DEPENDENCE OF THE SIGN OF δ OF A MIXED GAMMA-RAY TRANSITION ON ITS ORDER IN A CASCADE. S. Ofer (Brookhaven National Lab., Upton, N. Y.). Phys. Rev. 114, 870-1(1959) May 1.

An analysis of the angular correlation functions obtained for γ-ray cascades following the decay of Tb^{156} (5-day) illustrates that different signs of δ (defined as the ratio, in a mixed transition, of the reduced matrix element corresponding to multipole order L + 1 to that corresponding to multipole order L) have to be used in a case where a γ ray with mixed multipolarities is the first component of a cascade and in a case where the same γ ray is the second component of a cascade investigated if the formulas and tables of Biedenharn and Rose are used for the analysis of the angular correlations. (auth)

17270

RADIATIVE CAPTURE OF PROTONS IN Be^9. J. J. Singh (Univ. of Kansas, Lawrence). Phys. Rev. 114, 871-3(1959) May 1.

Measurements have been made on the proton-capture gamma rays in Be^9 at proton bombarding energies of 662 kev and 998 kev. Branching ratios for various levels in B^{10} are given. (auth)

17271

TRITIUM PRODUCTION BY 6-Bev PROTONS. Lloyd A. Currie (Pennsylvania State Univ., University Park). Phys. Rev. 114, 878-80(1959) May 1.

Tritium-formation cross sections for 6-Bev protons on various targets between C and Pb are reported. No significant variations in tritium-production cross sections are observed between 2 and 6 Bev. The problem of tritium production in nature is discussed briefly. (auth)

17272

MODIFIED ANALYSIS OF NUCLEON-NUCLEON SCATTERING. I. THEORY AND p-p SCATTERING AT 310 Mev. Peter Cziffra, Malcolm H. MacGregor, Michael J. Moravcsik, and Henry P. Stapp (Univ. of California, Berkeley and Livermore). Phys. Rev. 114, 880-6(1959) May 1.

A modified method of analyzing nucleon-nucleon scattering is discussed and applied to proton-proton scattering experiments at 310 Mev. The modified scheme is based on an explicit inclusion in all higher angular-momentum states of the terms contributed by the one-pion exchange process. This procedure is suggested by Chew's conjecture that the singularities of the scattering amplitude in the $\cos\theta$ plane (θ being the scattering angle in the center-of-mass system) that are closest to the physical region are due to the one-pion exchange process and are given by the Born approximation. Or, alternatively, in terms of ranges, the one-pion exchange contribution has the longest range of the forces contributing to the nucleon-nucleon interaction and hence should be primarily responsible for the contributions to the scattering amplitude in the high angular-momentum states. Since the only parameter in the Born approximation is the pion-nucleon coupling constant, the modified scheme can also provide a determination of this coupling constant. The application of the modified scheme to p-p scattering at 310 Mev indicates that the first two of the five best solutions of the conventional phase-shift analysis are more satisfactory than the others for two reasons. Firstly, their goodness-of-fit parameters improve markedly when the higher angular-momentum contributions are added, whereas those of the others remain essentially unchanged. Secondly, as a function of the coupling constant, the goodness-of-fit parameters of the first two solutions show minima close to the accepted value of the coupling constant. (auth)

17273

PHOTON AND ELECTRON POLARIZATION IN HIGH-ENERGY BREMSSTRAHLUNG AND PAIR PRODUCTION WITH SCREENING. Haakon Olsen (Norges Tekniske Høgskole, Trondheim, Norway) and L. C. Maximon (Norges Tekniske Høgskole, Trondheim, Norway and University, Manchester, Eng.). Phys. Rev. 114, 887-904(1959) May 1.

The matrix element for bremsstrahlung and pair production is written in a particularly simple form which reduces to the well-known matrix element for nonrelativistic energies, in terms of a vector which is closely related to the nonrelativistic current density vector. The cross section for high-energy bremsstrahlung and pair production involving arbitrarily polarized photons and electrons has been calculated. The Coulomb and screening effects are taken into account exactly. It is found that the screening and Coulomb corrections to the polarization-dependent part of the cross section are analytically of the same form and numerically of the same magnitude as the corrections to the polarization-independent part of the cross section found earlier. We also give the cross section for bremsstrahlung summed

over spin and polarization directions and integrated over the direction of motion of the final particle, i.e., the angular distribution of the radiation, which has a very simple form. Formulas are given for the linear and circular polarization of bremsstrahlung from arbitrarily polarized electrons and for the spin polarization of pairs from arbitrarily polarized photons. The circular polarization of bremsstrahlung from longitudinally polarized electrons is complete at the upper end of the spectrum and is much larger than from transversely polarized electrons throughout the spectrum. In the same way, circularly polarized photons produce longitudinally polarized electron-positron pairs, the probability of producing transversely polarized pair particles being, in general, much smaller. The faster one of the pair particles is always polarized in the same sense as the photon. On the other hand, the linear polarization of bremsstrahlung is smallest at the upper end of the spectrum and increases with decreasing photon energy. It is independent of the spin of the initial electron if one sums over the spin of the final particle. The circular polarization of the emitted photons is to a high degree independent of screening and Coulomb corrections, at the high energies considered here. The linear polarization is, however, significantly dependent on these corrections. Similar conclusions hold for pair production from circularly and linearly polarized photons, respectively. Finally, the electron spin-photon polarization correlation for bremsstrahlung and pair production is discussed. The depolarization, because of bremsstrahlung, of polarized electrons passing through matter is calculated and is appreciable over a radiation length. It is greater for a transversely polarized electron than for a longitudinally polarized electron. (auth)

17274

ENERGY DISTRIBUTIONS OF Li^8 FRAGMENTS EMITTED FROM C, Al, Cu, Ag, Au, AND U BOMBARDED BY 2.2-Bev PROTONS. Seymour Katcoff (Brookhaven National Lab., Upton, N. Y.). Phys. Rev. 114, 905-11(1959) May 1.

Targets of C, Al, Cu, Ag, Au, and U were irradiated with 2.2-Bev protons at the Brookhaven Cosmotron. The secondary fragments were collected in nuclear emulsions placed at various angles to the beam. From a study of the numbers and lengths of the "hammer tracks," the energy distributions of the ejected Li^8 fragments were derived for each target element at two or more angles. Analysis of the results, and comparison with evaporation calculations for Cu, Ag, and Au targets indicated the following: (1) in general, the observed spectra show considerably more high-energy Li^8 fragments than the calculated spectra; (2) the higher the fragment energy, the greater the tendency for emission in a forward direction; (3) from Ag, Au, and U targets, Li^8 may be ejected partially by an evaporation mechanism, but some other process must also play an important role; (4) for C, Al, and Cu targets, evaporation of Li^8 fragments from residual nuclei does not seem to be operating to any appreciable extent; (5) the Li^8 spectrum from Cu is surprising in that it lies higher in energy by several Mev than the Li^8 spectrum from Ag; (6) the spectrum of Li^8 from U is very similar to that from Au and there is no evidence for emission of Li^8 fragments from excited fission products; (7) the cross section is estimated to increase monotonically from roughly one millibarn for Al to roughly ten millibarns for U. (auth)

17275

STRENGTHS OF HIGH-ENERGY CAPTURE GAMMA RAYS IN W^{184}. D. J. Hughes, M. K. Brussel, J. D. Fox, and R. L. Zimmerman (Brookhaven National Lab., Upton, N. Y.). Phys. Rev. Letters 2, 505-6(1959) June 15.

A possible method for spin measurement is based on capture gamma rays emitted from individual levels. The most direct use of capture gamma rays for the determination of J applies when the ground-state transition is allowed for only one of the spins. An example is the compound nucleus W^{184}, in which the electric dipole ground-state transition at 7.42 Mev is allowed for J = 1 but forbidden for J = 0. No information exists concerning the relative transition probabilities involved. Earlier capture gamma measurements with the Brookhaven fast chopper showed strong ground-state transitions for several known resonances of W^{184}, indicating that J = 1 for these resonances. Transition probabilities of the ground-state gamma rays for the five J = 1 levels are tabulated. (A.C.)

17276

SYSTEM OF LEVELS IN EVEN-EVEN NUCLEI. C. A. Mallmann (Argonne National Lab., Lemont, Ill.). Phys. Rev. Letters 2, 507-9(1959) June 15.

The existence of a system of levels in even-even nuclei whose energies are related by an empirically determined law which seems to be applicable throughout the nuclear chart is investigated. Experimental energy ratios with their errors are tabulated for 29 elements. (A.C.)

17277

ELECTROMAGNETIC CORRECTIONS TO THE B^{12}-N^{12} β-SPECTRUM RATIO. Murray Gell-Mann and S. M. Berman (California Inst. of Tech., Pasadena). Phys. Rev. Letters 3, 99-101(1959) July 15.

It has recently been suggested that a precise comparison of the β spectra of B^{12} and N^{12} transitions to the ground state of C^{12} would provide a test of the nature of the vector interaction in β decay. If S(E) represents the spectrum of each transition divided by the corresponding Fermi spectrum then (1) $R(E) \equiv S(E,B^{12})/S(E,N^{12})$, where E is the total energy of the beta ray, may be written. Current β decay theory predicts that (2) $R(E) \approx$ const $(1 + AE)$. A new theoretical estimate that should be applied to Eq. 2 to take account of electromagnetic effects is given. (A.C.)

17278

ANGULAR DISTRIBUTIONS OF HIGH ENERGY PROTONS INELASTICALLY SCATTERED BY LIGHT NUCLEI. D. J. Hooton and G. R. Allcock (Univ. of Liverpool). Proc. Phys. Soc. (London) 73, 881-93(1959) June.

The effect of the central optical potential in the quasi-elastic scattering of high-energy nucleons is treated by the semi-classical approximation. For non-radial excitation of the nucleus the optical potential leads to a considerable angle-independent reduction in intensity. It also produces some forward scattering when two units of orbital angular momentum are communicated to the nucleus by the scattered particle. The angular distributions for radial nuclear excitation are more seriously distorted by the optical potential; the main effect here consists in a more or less angle-independent reduction in intensity of the diffraction peaks, and the appearance of a large extra peak in the forward direction. (auth)

Theory

17279 AFOSR-TN-59-624

Maryland. Univ., College Park.

SUGGESTED PAIR DISTRIBUTION FUNCTION FOR STRONGLY INTERACTING PARTICLES. Technical Report No. 134. Robert Ayers. May 1959. 24p. Contract AF49(638)-399. (AD-217688).

A simple treatment of the many-body problem is given using standard methods, but especially emphasizing the connection between the two-body distribution functions in momentum space and configuration space. With the results obtained, the first order energy of the hard-sphere, "soft-sphere," square-well and Lennard-Jones gases obeying either Fermi or Bose statistics are easily reproduced. (auth)

17280 NP-7725

Joint Inst. for Nuclear Research., Dubna, U.S.S.R. Lab. of Theoretical Physics.

ON THE COULOMB EFFECTS IN THE THEORY OF SUPERCONDUCTIVITY. D. V. Shirkov. 1959. 16p.

A new form of the connection between matrix elements of the functional derivatives of the Feynman scattering matrix and those of the energy operator is established. This form contains no infinite δ factors or transitions to the limit. The kernel of the integral equation of compensation of "dangerous" electronic graphs in the theory of superconductivity is expressed by this way in terms of usual Green functions. The summation of the Coulomb singularities in the kernel of the compensation equation is performed by means of the renormalization group method in the approximation of an electron gas at high density. The results of summation in the lowest approximation coincide with the formulae obtained before in a qualitative way. (auth)

17281

KINETIC EQUATION FOR A PLASMA WITH UNSTEADY CORRELATIONS. C. M. Tchen (National Bureau of Standards, Washington, D. C.). Phys. Rev. 114, 394-411(1959) Apr. 15.

As a generalization of the Boltzmann equation, the kinetic equation for a plasma is derived in the form of a generalized Fokker-Planck equation, by considering unsteady correlations, including non-Markovian and nonlinear behavior. Both the binary and ternary correlations are used for many kinds of particles with different temperatures. The coefficients of the kinetic equation depend on the law of interaction for a pair of particles and are influenced by relaxation. The effective potential of friction consists of two parts: the static part corresponds to the Debye potential and is isotropic, the dynamical part is axially symmetrical about the direction of motion, and causes a dynamical friction. The results show that the friction is proportional to velocity for slow particles, and inversely proportional to the square of velocity for fast particles. This tendency of the fast particles to overcome repulsion is a property connected with the "run-away" of electrons. A criterion for maximum friction is derived. The triplet interaction, which mainly affects the shielding phenomena, assures the convergence of the coefficients in case of distant interaction. Since the length scales of interaction are well determined in this way, the kinetic equation can be expected to be valid over a longer range than does the Boltzmann equation. The large scale agrees with the Debye radius, when the shielding term is linearized, as should be expected. When time relaxation is left aside and linearization is made, the kinetic equation degenerates to the classical Fokker-Planck equation with convergent coefficients. (auth)

17282

INTERACTION OF CHARGED PARTICLES WITH A DEGENERATE FERMI-DIRAC ELECTRON GAS. R. H. Ritchie (Oak Ridge National Lab., Tenn.). Phys. Rev. 114, 644-54(1959) May 1.

Expressions for the self-energy and interaction probability of charged particles in a degenerate Fermi-Dirac electron gas are given, generalizing from the dielectric theory of Lindhard and Hubbard and treating interactions between electrons in the gas by first order perturbation theory. Numerical results for the interaction probability in a particular case are presented. A more general Feynman diagrammatic analysis of interaction in the gas is carried out, yielding results in agreement with the more elementary approach. (auth)

17283

EXCHANGE ENERGY OF AN ELECTRON GAS IN A STRONG MAGNETIC FIELD. G. Dresselhaus (Cornell Univ., Ithaca, N. Y.). Phys. Rev. 114, 736-8(1959) May 1.

The magnetic field variation of the exchange energy of a free-electron gas is calculated by deriving the form of the "Fermi hole" around each electron. The wave functions which are used exactly diagonalize the kinetic energy. The resulting charge distribution is integrated to find the exchange energy. The exchange energy has the same periodicity in the reciprocal magnetic field which is displayed by the kinetic energy. Hence, it is concluded that the de Haas–van Alphen effect is unchanged by the field variation of the exchange energy except for a possible shift in the phase of the oscillations. (auth)

17284

DIRECT INTERACTION WITH STRONG COUPLING IN NUCLEAR COLLISIONS. C. B. O. Mohr (Univ. of Melbourne). Proc. Phys. Soc. (London) 73, 894-904(1959) June.

For direct nuclear reactions in which there is a large probability of a particular inelastic collision, coupling between the waves in the two channels will modify the elastic and inelastic scattering as given by the distorted wave approximation. The extent of the modifications is investigated for the simplest case of E0 excitations, taking rectangular wells for the nuclear potential and the transition potential. The case of several open channels is briefly considered. (auth)

RADIATION EFFECTS ON MATERIALS

17285 AERE-R-2889

United Kingdom Atomic Energy Authority. Research Group. Atomic Energy Research Establishment, Harwell, Berks, England.

AN EXPERIMENT CONCERNING THE PRESENCE OF FREE GASES IN IRRADIATED BERYLLIA. T. K. Ghosh and F. J. P. Clarke. Apr. 1959. 8p.

The formation of free gases in BeO during reactor irradiation by mechanisms other than those involving the (n, α) reaction is found to be less than 3×10^{-4} cc per cc of BeO at N.T.P. This amount is orders of

magnitude less than that obtained by other workers, and reasons for this are discussed. (auth)

17286 CF-58-7-63
Oak Ridge National Lab., Tenn.
ANALYSIS OF THE STATUS OF CHROMIUM IN SOLUTION UNDER IN-PILE CONDITIONS. J. C. Banter, J. E. Baker, and R. J. Davis. July 15, 1958. 27p. Contract [W-7405-eng-26]. $4.80(ph), $2.70(mf) OTS.

A summary of the Cr data from the HRP in-pile corrosion program is examined in an effort to determine the Cr species present in such solutions under in-pile conditions. Data from previous in-pile bomb and loop experiments pertinent to Cr behavior are tabulated, and correlations are offered to support a proposed model. It is pointed out that other interpretations of the same data are possible, and to obtain conclusive evidence as to the identity of Cr species in these solutions, especially designed experiments are necessary. (J.R.D.)

17287 NP-7717
Wyandotte Chemicals Corp., Wyandotte, Mich. and Illinois. Univ., Urbana.
SYNTHESIS AND EVALUATION OF HIGH TEMPERATURE STABLE AND NUCLEAR RADIATION STABLE METAL-CYCLOPENTADIENYL FLUIDS. Progress Report No. 7 Covering period March 15, 1959 to May 30, 1959. 37p. Project Nos. 9-(2-3044) and 9-(8-7312). Contract AF33(616)-5053.

In a search for fluids suitable for use as high-temperature hydraulic fluids and lubricants, six new siloxanylferrocenes were synthesized and physical properties and thermal stability determined. The route to these compounds involved cleavage of the siloxane linkage in 1,3-(1,1′-ferrocenylene)-tetramethyldisiloxane with phenyllithium, methyllithium, or 1-piperidyllithium and treatment of the resulting lithium siloxides with phenyldimethylchlorosilane, dimethyldichlorosilane, methyltrichlorosilane, tetrachlorosilane, or 1,1′-bis (dimethylchlorosilyl)-ferrocene. Another candidate ferrocene was prepared via 3-cyclopentadienyl-1,5-diphenylpentamethyltrisiloxane. An effort to prepare polymers by hydrolysis of 1,1′-bis(methyldiethoxysilyl)-ferrocene yielded a solid dimer (60-70%), 2,4-(1,1′-ferrocenylene)-6,8-(1,1′-ferrocenylene)-tetramethyl-cyclotetrasiloxane. Although stable at 366°C, three representative siloxanylferrocenes tested 10 hr at 427°C (800°F) lost from 6 to 17% in weight, one decomposition product being ferrocene. Metalation of ferrocene and of 1,1′-dimethylferrocene and subsequent carboxylation gave excellent yields of the acids from the respective organometallics. Inverse carboxylation led to stable polyketones. Treatment of lithioferrocene with methoxyamine gave aminoferrocene in excellent yield. Desoxyferrocoin was characterized and shown to give ferrocil upon oxidation with manganese dioxide. (For preceding period see NP-7172.) (auth)

17288 NP-7743
Battelle Memorial Inst. Radiation Effects Information Center, Columbus, Ohio.
MONTHLY ACCESSION LIST NO. 25 [ON RADIATION EFFECTS DATA]. July 15, 1959. 22p. Project No. 2133. Contract AF33(616)-6564.

17289 REIC-3(Add.)
Battelle Memorial Inst. Radiation Effects Information Center, Columbus, Ohio.
THE EFFECT OF NUCLEAR RADIATION ON ELASTOMERIC AND PLASTIC MATERIALS (FIRST ADDENDUM). N. J. Broadway and S. Palinchak. May 31, 1959. 53p. Project No. 2133. Contract AF33(616)-6564. (AD-210759).

The radiation-effects information on the various elastomers and plastics for which data have been published during 1958 is summarized. Radiation polymerization and radiation vulcanization are not included except as such data have some bearing on the effects of radiation on the finished polymer. This addendum report used as a supplement to REIC Report No. 3 is intended to be sufficiently inclusive to make it valuable as a reference guide on the effects which can be anticipated from nuclear radiation on elastomers and plastics. (auth)

17290 REIC-Memo-10
Battelle Memorial Inst. Radiation Effects Information Center, Columbus, Ohio.
FORMAT FOR REPORTING RADIATION-EFFECTS DATA. J. F. Kircher. May 15, 1959. 14p. Project No. 2133. Contract AF33(616)-6564.

The format used by the Radiation Effects Information Center (REIC) in reporting radiation-effects data is given. From the discussion, it is apparent that there is no simple way of reporting radiation-effects data that is applicable to all situations, nor is there any one unit that can be used to cover all situations. It is felt, however, that the methods and terminology outlined in this memorandum are the best available today that are generally applicable to nuclear-propulsion development programs. Recommendations for neutron and gamma-ray dosimetry techniques are given. The terminology used by the REIC is presented. Since there is not complete agreement among those working with radiation as to the best way of reporting or correlating data, the usage must be somewhat arbitrary. It is hoped that, by consistent usage of terms, the task of interpreting data from REIC Reports and Memoranda will be simplified. (auth)

17291 REIC-Memo-16
Battelle Memorial Inst. Radiation Effects Information Center, Columbus, Ohio.
THE EFFECT OF NUCLEAR RADIATION ON REFRIGERANTS. Robert E. Wyant. June 30, 1959. 8p. Project No. 2133. Contract AF33(616)-6564.

The information available at the Radiation Effects Information Center on the radiation stability of the common refrigerants is summarized. For most of the refrigerants only a meager amount of information is now available. Freon 11 appears to have a damage threshold slightly below 10^9 ergs g^{-1} absorbed energy when irradiated at −70°C. At higher irradiation temperatures the threshold would be lower. In the irradiation of ammonia, a radiochemical equilibrium point exists at which the decomposition products, nitrogen and hydrogen, recombine to form ammonia. This equilibrium point is at 24.6% decomposition. This equilibrium is not reached until the dose exceeds 4.31×10^{18} n cm^{-2}. The radiolytic decomposition of carbon dioxide appears to depend not only upon the state of the carbon dioxide but also upon the presence under which the irradiation is carried out. Propane and methyl chloride do not show good radiation resistance. In the case of methyl chloride, one of the radiolysis products is hydrogen chloride, which might tend to be somewhat corrosive. (auth)

17292 REIC-Memo-17
Battelle Memorial Inst. Radiation Effects Information Center, Columbus, Ohio.
THE EFFECT OF NUCLEAR RADIATION ON FLUOROPOLYMERS. N. J. Broadway and S. Palinchak.

June 30, 1959. 20p. Project No. 2133. Contract AF33(616)-6564.

Radiation tolerance levels of a representative number of fluoropolymers are summarized. Except for Teflon and Silastic LS-52, the various fluoropolymers have approximately the same radiation resistance. An investigation was made for the use of these materials in a radiation environment. It was found that the radiation resistance of fluoropolymers is not as good as their heat and chemical resistance. Teflon has very poor radiation resistance and other fluoropolymers are slightly better. (J.E.D.)

17293 REIC-Memo-18

Battelle Memorial Inst. Radiation Effects Information Center, Columbus, Ohio.

THE EFFECT OF NUCLEAR RADIATION ON THE PERFORMANCE OF A HYDRAULIC FLIGHT-CONTROL SYSTEM. Raymond E. Hess and R. F. Badertscher. June 15, 1959. 15p. Project No. 2133. Contract AF33(616)-6564.

Hydraulic flight-control-system components are subject to radiation-induced failures. For nuclear-powered aircraft, the components of the flight-control system will probably be located in a high radiation flux. This high level of radiation coupled with continuous operation can result in failure or control degradation. By proper design during the early stages of the aircraft development, certain components of the utility hydraulic system could be planned as stand-by units to take over the function of a failed component. Designing into the utility system a capability equivalent to the flight-control system could impose serious design penalties. Another stand-by concept would be to duplicate the system. This would be impractical on the basis of weight and space. Definite answers to the problem of providing a suitable hydraulic flight-control system for nuclear-proved aircraft will only result from detailed design studies. (A.C.)

17294 IGIS-22(RD/R)

THE ANNEALING OF THE G.I. GRAPHITE. M. Pascal. Translated by H. C. Cowen (U.K.A.E.A., Risley) from Bull. inform. sci. et tech. (Paris), No. 23, 11-12(1958). 3p.

This paper was previously abstracted from the original language and appears in NSA, Vol. 13, as abstract No. 8254.

17295 SCL-T-254

FLUORESCENCE SPECTRA OF NATURAL AND IRRADIATED DIAMONDS. (Spectres de Fluorescence des Diamants Naturels et Irradiés.) I. G. Matthews. Translated by Marcel I. Weinreich (Sandia Corp.) from J. phys. radium 17, 649(1956). 4p. $1.80(ph), $1.80 (mf) JCL.

Double structure and separation of spectral components in the fluorescence spectra of natural and irradiated diamonds are discussed. (J.E.D.)

17296

THE MECHANICAL PROPERTIES OF IRRADIATED NIOBIUM. M. J. Makin and F. J. Minter (Atomic Energy Research Establishment, Harwell, Berks, England). Acta Met. 7, 361-6(1959) June.

The effect of heavy neutron irradiation (~10^{20} n cm^{-2}) at 16°C on the mechanical properties of niobium has been investigated. Only a moderate increase in yield strength occurred immediately on irradiation (61,000 lb/$in.^2$ to ~77,000 lb/$in.^2$) but on annealing in the temperature range 125 to 175°C there was a further large increase with the formation of a yield drop at the start of the deformation. The activation energy has been measured, 1.30 ± 0.1 ev, and it is concluded that the process is due to vacancy migration, the yield drop being due to the condensation on dislocations of vacancies produced during irradiation. Recovery of irradiation hardening commences at 350°C and is complete after 1 hr at 600°C. Technologically the most serious irradiation effect is the very large reduction in uniform elongation before fracture (17 per cent to <2.0 per cent) a consequence of a complete lack of capacity to work harden in irradiated material. Hence deformation, once started, continues in the same place until fracture occurs. The reduction in area at the fracture is quite large in the irradiated material (~50 per cent c.f., 80 per cent in unirradiated niobium). (auth)

17297

THE EFFECT OF γ RADIATION ON SOLID BODIES, ESPECIALLY METALS. F. Bollenrath and K. H. Lindackers (Rheinisch-Westfalischen Technischen Hochschule, Aachen). Atomkernenergie 4, 201-3(1959) May. (In German)

In nuclear reactors radiations of different character are affecting materials simultaneously. Only the integral influence of all of them together can be determined. The effect of γ radiation may be observed separately, when γ-sources with sufficient intensity are applied. The conditions for producing displacements of atoms in solids, especially in metals, with γ rays are discussed. Finally, directions for experimental study, e.g., with Co^{60}, and an estimation of the number of atomic displacements are given. (auth)

17298

EFFECT OF NEUTRON IRRADIATION ON THERMALLY AND MECHANICALLY INDUCED NONEQUILIBRIUM STATES IN AuCu. R. L. McCollum and G. Allen (National Aeronautics and Space Administration, Cleveland). J. Appl. Phys. 30, 1105-8(1959) July.

Studies have been made of the effect of neutron irradiation on the resistivity and magnetoresistivity of the alloy AuCu when subjected to various pre-irradiation thermal and mechanical treatments. The specimens were exposed to estimated fast neutron fluxes up to 7.3×10^{18} neutrons/cm^2 in the Brookhaven pile. In the case of thermally disordered specimens, the effect of the irradiation was to decrease the resistivity in completely disordered states and to increase the resistivity in completely ordered states; viz., there was some tendency for specimens to reach intermediate degrees of order. The effect on mechanically disordered specimens was to increase the resistivity in all cases. The irradiation effected a larger percentage change in the coefficient of magnetoresistivity than in the resistivity. (auth)

17299

EFFECTS OF ELECTRON BOMBARDMENT UPON BROMIDES OF CADMIUM AND SILVER. Sho Suzuki (Government Chemical Industrial Research Inst., Tokyo). Nature 183, 1755-6(1959) June 20.

Observations are reported on silver bromide and cadmium bromide subjected to electron bombardment. Results suggest the existence of an effect of crystal structure on the morphological changes produced by electron bombardment. (C.H.)

17300
A STATISTICAL THEORY OF LATTICE DAMAGE IN SOLIDS IRRADIATED BY HIGH-ENERGY PARTICLES. L. I. Pál and G. Németh (Hungarian Academy of Sciences, Budapest). Nuovo cimento (10) 12, 293-309 (1959) May 16.

The distribution function for the number of lattice displacements in solids irradiated by high-energy particles has been determined by means of exact methods of the theory of probability. The generating function of the distribution function yields equations determining the average number of displacements and their dispersion. These equations have been solved on the assumption that the primary bombarding particles are neutrons and that the collision phenomena between a displaced atom and an atom vibrating in the lattice may be regarded as collisions between perfectly rigid spheres. It has been found that the variance of the number of lattice displacements is larger than the variance of Poisson's distribution for the case of irradiation by fission neutrons. (auth)

17301
ELECTRON MICROSCOPIC EXAMINATION OF NEUTRON IRRADIATED LiF CRYSTALS. E. Schüller and J. Schepers (Studiecentrum voor Kernenergie, Mol, Belgium). Physica 25, 487-8(1959) June.

Neutron-irradiated LiF crystals were examined by electron microscopy. In some experiments, cleaved single crystals were etched before irradiation in the graphite reactor BR-1. Only one crystal received a dose of 9×10^{17} thermal n/cm^2. In this one, remarkable variations of the etchpits occurred. The second result of interest is the appearance of randomly distributed ramified wrinkles for doses higher than 2.5×10^{17} thermal n/cm^2. (A.C.)

RADIOACTIVE WASTE

17302 AAEC/E-11
Australia. Atomic Energy Commission Research Establishment, Lucas Heights, New South Wales.
SOME DESIGN DATA FOR GAMMA SHIELDING IN N.S.W. D. R. Ebeling. Dec. 1957. 25p.

It is indicated that the use of pits and ponds is the cheapest method of containing active materials but that many things can make these methods impracticable. Concrete is thought to be the most generally useful material for above-ground shields and high density shields can be made comparably cheaply by using steel punchings, ilmenite sand, iron ore or a combination of these. Lead and cast iron are among the most expensive shielding materials but they can often be justified because of their compactness. Costs are included wherever possible. A quick method of calculating shielding thicknesses is included in the appendices. (auth)

17303 UCRL-8684
California. Univ., Berkeley. Lawrence Radiation Lab.
A METHOD FOR THE SOLIDIFICATION OF RADIOACTIVE AQUEOUS LIQUID WASTES. John A. Kaufman and Nelson B. Garden. Mar. 13, 1959. 20p. Contract W-7405-eng-48. $0.50(OTS).

Progress is reported on a successful method for the solidification of radioactive liquid waste. Portland cement, mixed with expanded vermiculite, is added to the waste until all liquid is absorbed. The solidified waste is handled and stored as a solid waste package. Procedures in applying this method to various wastes are described. Quantities of waste, special circumstances, and economic considerations will determine where this method is most applicable. (auth)

REACTORS

General

17304 AD-143396
North Carolina State Coll., Raleigh.
EXCESS FUEL ADDITION. Raymond L. Murray. May 8, 1957. 11p.

Fuel was added to the Raleigh Reactor core in steps of 1.5 g U^{235} and rinsed with water at each stage. Critical control rod position for each fuel addition is tabulated. In addition, semi-log plots of counting rate as a function of time are presented, with the best straight line drawn through the data for computation of period. The mass coefficient of reactivity is computed to be 3.07 to 3.69×10^{-4}/g. (J.R.D.)

17305 CF-58-3-110
Oak Ridge National Lab., Tenn.
REACTIVITY LIFETIMES OF SLIGHTLY ENRICHED HOMOGENEOUS REACTORS. Seymour Jaye and M. P. Lietzke. Mar. 17, 1958. 16p. Contract [W-7405-eng-26]. $3.30(ph), $2.40(mf) OTS.

Reactivity lifetimes of 12- and 15-foot, one-region homogeneous reactors have been calculated as a function of uranium concentration. For both sizes, the maximum lifetime occurs at a U^{238} concentration of 500 gm/l and is 5700 and 6700 Mwd/ton, respectively. If the fission product gases were removed continuously, these lifetimes increase approximately 50%. (auth)

17306 CF-58-9-60
Oak Ridge National Lab., Tenn.
STATISTICAL SURVEY OF HB-5 ROCKING AUTOCLAVE THERMOCOUPLE READINGS. W. C. Ulrich. Sept. 16, 1958. 19p. Contract [W-7405-eng-26]. $3.30(ph), $2.40(mf) OTS.

Thermocouple readings from eleven HB-5 experiments were statistically surveyed to determine if a temperature gradient is in evidence along the length of the autoclave. The data on temperature distributions observed during operation of HB-5 rocking autoclaves are presented graphically, and it is concluded that at the 5% critical level during zero power operation there is no temperature gradient along the autoclave; however, during in-pile (at power) operation there is. (J.R.D.)

17307 CRP-333
Atomic Energy of Canada Ltd., Chalk River, Ont.
THE TIME VARIATION OF PILE POWER DUE TO PERIODIC MODULATION OF THE EFFECTIVE MULTIPLICATION CONSTANT. V. H. Rumsey. July 1959. Date of MS. June 19, 1947. 14p. (PD-217; AECL-844). $0.50(AECL).

When k_e is an oscillating function of time the differential equation for pile power cannot be solved explicitly. It is customary to obtain an approximate solution (the first order approximation) by ignoring all terms involving the square or higher powers of the percentage modulation. A more accurate solution is obtained here by retaining the second order terms; it takes the form of the first order approximation plus a correction. For swing measurements made on the ZEEP with a 20-

second period, the correction is of the order of one per cent. Graphs showing the relation between power modulation and k modulation are given for typical heavy water and graphite piles. (auth)

17308 CRP-848

Atomic Energy of Canada Ltd. Chalk River Project, Chalk River, Ont.

MEASUREMENTS OF THE EFFECTIVENESS OF GATES FOR ATTENUATING NEUTRON BEAMS FROM REACTOR BEAM HOLES. J. M. Robson. June 1959. 10p. (AECL-849). $0.50(AECL).

Two arrangements of research reactor beam hole gates for neutron attenuation were evaluated. The effectiveness of these gates was measured during reactor startup experiments. The arrangements for the two experiments are described, and the effectiveness of each is discussed and compared with the other. (J.R.D.)

17309 HW-60674

General Electric Co. Hanford Atomic Products Operation, Richland, Wash.

DIVISION OF REACTOR DEVELOPMENT PROGRAMS MONTHLY REPORT [FOR] MAY 1959. M. Lewis, comp. June. 15, 1959. 34p. Contract [W-31-109-Eng-52]. $6.30(ph), $3.00(mf) OTS.

Experiments to determine the effects of PuO_2 additions on sinterability of UO_2 progressed to the point that some conclusions were drawn. Pu metal was heated with excess carbon; the resulting compounds were the phases PuC and Pu_2C_3. Fabrication studies included work on Al–Zr metallurgical bonds, reduction of alumina-filled stainless steel cans by rolling, and a thermal cycling test of a full-length Zircaloy-clad wire-wrapped dummy element. Also, corrosion testing of Al rods is reported. Fabrication technique development such as cross section reduction for thin wall tubing by a swaging technique and a control device for hot swaging are reported. Good corrosion resistance in hot-swaged Zircaloy-2 clad fuel elements is reported. In fuel evaluation a UO_2 fuel rod was irradiated in the ETR for six days prior to a fission-caused break; results of examination are given. Results of Zircaloy-2 hydriding tests are tabulated. In coolant systems testing, loop tests on Zircaloy-2 clad PRTR fuel elements are reported in which only a minor amount of swelling was noted, also results of thermal cycle tests on PRTR fuel elements are given. In thermal studies, heat transfer experiments to evaluate the requirements for air cooling PRTR fuel elements were completed; data are being evaluated. Various pump and other reactor auxiliary tests are reported in mechanical development testing. In reactor technology development, the PRTR safety circuit was studied, and a recommendation was made to remove several trips, thus decreasing the number of spurious scrams. The construction status of PRTR and several components is reported in relation to the various phases along with development in the Pu fabrication pilot plant. Results of aged UO_2 molten salt cycling to observe the behavior of fission products are reported as well as a molten salt cycling procedure for ThO_2–UO_2 separation. Nuclear safety limits for air shipment of Al–Pu alloys are reported. A discussion of criticality resulting in case of a PRTR fuel meltdown is given. Progress in the RBU code is summarized; the Monte Carlo portion is complete, while the diffusion and burnup have not been tested with a sample problem. In the basic swelling studies program, evaluation of thermocouples and heating elements for the swelling behavior capsule is reported. In addition, studies of rare gas diffusion through U are in progress using helium. The pore size distribution in U is also being studied. Comparisons of PCTR and GCR lattices are presented in the central station reactor program section. Preirradiation tests of silicon carbide coated reactor grade graphite are reported; the samples were subsequently charged into the KE reactor. Progress is reported in fixation of radioactive wastes such as the destruction of sodium nitrate in spray calciners by addition of sugar and investigations of decontamination of low-level wastes by allowing aluminum hydroxide to scavenge radioactive material from the D-2 Redox stream. Data are given on column ion exchange removal of Cs^{134} from a 0.6 gal/min/ft^2 stream. (For preceding period see HW-60331.) (J.R.D.)

17310 IDO-16516

Phillips Petroleum Co. Atomic Energy Div., Idaho Falls, Idaho.

HYDRAULICS OF ETR-MTR CAPSULE EXPERIMENTS. R. G. Beck. May 28, 1959. 44p. Contract AT(10-1)-205. $1.25(OTS).

Supplement to IDO-16368.

An experimental study of the hydraulics of fixtures used to hold capsules for irradiation in the ETR was made in an out-of-pile hydraulic test facility. The results are presented to supplement a report giving methods of calculating coolant flow through experiments in the ETR or MTR (Ref. IDO-16368). Test results indicate that calculated flow rates through experiments in the ETR or MTR are usually about 15 to 30% different than measured flow rates. Capsule experiments are loaded into thin-walled aluminum tubes designed for irradiation in holes provided in the MTR and ETR core and reflector. Several different types of tubes are used to hold the capsules, which usually have outside diameters of $\frac{5}{8}$ inch, $1\frac{1}{8}$ inch, or 1 inch. These tubes are called S-baskets, X-baskets, SB-baskets, and B-baskets. Results obtained with baskets full of solid capsules for conditions corresponding to ETR operation with a core pressure differential of 55 psi, and MTR operation with a core pressure differential of 40 psi are tabulated. (auth)

17311 IDO-16524

Phillips Petroleum Co. Atomic Energy Div., Idaho Falls, Idaho.

SPENT FUEL ELEMENT ACTIVITY AND CORE BURNUP DISTRIBUTION FROM THE MTR PLUTONIUM CORE LOADING. J. M. Waage. June 12, 1959. 21p. Contract AT(10-1)-205. $0.75(OTS).

During August of 1958 the MTR operated on a plutonium fuel core loading for a total of 262 Mwd. Following this experimental operation, the gamma decay doserate from the spent fuel elements was measured throughout the cooling period. Elements with a fuel burnup from 6.8 to 31 Mwd were scanned from 4 hours after reactor shutdown to 150 days. These data are presented along with the comparison of activity from a typical plutonium element and a standard MTR element. Core burnup distribution was calculated using average and peak flux values in addition to the fission product activity from the elements in the core. The distribution from the average flux calculation is in good agreement with that obtained by the use of data from the fission product activity. Data currently in use for gamma irradiation from spent uranium elements may be applied with little change to spent plutonium elements. (auth)

17312 KAPL-2000-6
Knolls Atomic Power Lab., Schenectady, N. Y.
REACTOR TECHNOLOGY REPORT NO. 9—ENGINEERING. June 1959. 162p. Contract W-31-109-Eng-52. $3.00(OTS)

Reactor Design. Tests were conducted to observe visually and to photograph the phenomenon of reactor parallel-plate fuel assembly collapse and to witness inlet flow conditions. The effect of flow redistribution on the critical flow velocity for collapse of reactor parallel-plate fuel assemblies was investigated. An extensive series of tests was conducted on the flow-induced vibration and resultant wear in twisted-ribbon fuel elements. Discontinuity stresses between cylinders of unequal thickness were investigated. A full-size reactor pressure vessel, for a pressurized water reactor, was subjected to controlled heating and cooling cycles at design pressures and temperatures. The test was designed to simulate heat transfer conditions existing in an actual reactor insofar as they affected the pressure vessel. Use of a 4-in.-ID thin-walled part of AISI 410 stainless steel tempered at 650°F to hardness RC36-42 as a pressure-retaining member in a high temperature, high purity, water environment was studied. The construction of an Inconel corrosion testing facility is reported. Heat Transfer and Fluid Flow Analysis. Data are presented for a class of reactor fuel elements that have strong secondary flows and strongly skewed boundary layer flows. Tests to measure twisted-ribbon fuel element temperatures at high fluxes and low pressures were completed. Departure from nucleate boiling tests were conducted on oval twisted ribbons with upflow of water at 2000 psia. Power Plant Component Design. The development and testing of a model dashpot for retarding the closure of a specific swing-type check valve used in the main coolant loops of a pressurized-water nuclear power plant are described. Strain cycling tests are reported on large specimens of AISI type 347 stainless steel and $2\frac{1}{4}$ Croloy. The pressure stresses at the junction between a support skirt and pressure vessel were investigated. The post-yield bending of rectangular sections was investigated. A digital computer solution is presented for axisymmetric loads and temperature distributions in cylinders. Irradiation Testing. A creep-test facility was developed to test irradiated samples with the accuracy obtained on non-irradiated samples. Design problems of the fixed gas annulus irradiation capsule are discussed. The design of a constant temperature irradiation capsule is presented. The design of high temperature density measuring equipment is reported. Results of neutron flux monitoring of in-pile irradiations are presented. (For preceding period see KAPL-2000-5.) (W.L.H.)

17313 NP-7608
General Electric Co., Schenectady, N. Y.
BOILING WATER REACTOR STABILITY. J. W. Weil, ed. 1957. 42p. (GER-1468).

Extensive studies of the dynamics of boiling reactor systems show that the chugging oscillations which are observed in low-pressure systems will not appear in large reactors designed for power stations. Methods of system analysis which may be used to reliably predict the reactivity characteristics of given reactor plants are described. (D.E.B.)

17314 ORNL-2735
Oak Ridge National Lab., Tenn.
CORROSION STUDIES FOR THE HRT CHEMICAL PROCESSING PLANT. J. L. English, J. C. Griess, and D. J. Krause. July 24, 1959. 42p. Contract W-7405-eng-26. $1.25(OTS).

The corrosion resistance of a number of materials considered for use in the HRT Chemical Processing Plant was determined in H_2SO_4 solutions. Ta was found to be fully resistant to boiling 4 M and 10.8 M H_2SO_4 solutions used for the dissolution of corrosion and fission products removed from the homogeneous-reactor fuel solution. Ta was immune to H_2 embrittlement in these solutions. Crystal-bar Zr and Zircaloy-2 were fully resistant to attack by boiling 4 M H_2SO_4 solution but were attacked at rates of 5 to 10 mpy in boiling 10.8 M H_2SO_4 solution. Carpenter 20-Cb stainless steel was completely resistant to 4 M H_2SO_4 solutions at 38°C, the temperature in the decay storage vessels of the chemical processing plant, and generally was resistant to similar H_2SO_4 solutions at atmospheric boiling temperature, ~110°C. In a few isolated cases, however, the alloy was prone to stress-corrosion cracking and to knife-line attack in several of the boiling 4 M H_2SO_4 environments. Corrosion rates of types 347 and 316 stainless steel in boiling 4 M H_2SO_4 solution were in excess of 75,000 mpy; however, in the presence of synthetic corrosion and fission products, corrosion attack was reduced to 10 mpy or less. A similar, but less drastic, reduction in the rate of attack on Carpenter 20-Cb stainless steel was experienced with additives present in the boiling 4 M H_2SO_4 solution. The corrosion rate of the latter alloy in boiling and helium-aerated 4 M H_2SO_4 solution was accelerated by Ru, a fission-product element. (auth)

17315 UCRL-5477
California. Univ., Livermore. Lawrence Radiation Lab.
PULSED NEUTRON SOURCE STUDIES OF GRAPHITE-ENRICHED URANIUM SYSTEMS. Fred A. Kloverstrom and Ted T. Komoto. Feb. 5, 1959. 24p. Contract W-7405-eng-48. $0.75(OTS).

A pulsed neutron source study of unreflected, near-homogeneous, graphite-enriched-uranium systems was carried out in conjunction with a criticality measurements program. The neutron population in a subcritical system, following injection of a burst of neutrons, decreases exponentially. The decay constant of this decrease is the measured quantity in the pulsed source experiments. The value of the decay constant has been found for several bucklings near critical for each of five fuel concentrations. The experimental techniques are described, and the variation of the decay constant with buckling and fuel concentration is qualitatively discussed. (auth)

17316
THE NUMERICAL SOLUTION OF THE 2-GROUP DIFFUSION EQUATION FOR MULTI-REGION REACTORS BY MEANS OF AN ELECTRONIC DIGITAL CALCULATOR. Josef Rembser and Erhard Fischer. Atomkernenergie 4, 186-9(1959) May. (In German)

The neutron flux distribution in a critical thermal reactor is described in good approximation by the differential equations of the two-group diffusion theory. The solution of these equations requires extensive calculations even in the case of simple geometry, which can be successfully done using electronic digital computers. The analytical solution of the two-group equations is discussed for a cylindrical reactor consisting of several different regions. The problem can also be solved numerically by the difference method, which is presented

in some detail. Results are given for a special example. (auth)

17317

CIRCUITS FOR THE GAS-COOLED HIGH-TEMPERATURE REACTOR. W. Spillmann and R. Tognoni (Escher Wyss AG, Zurich). Atomkernenergie 4, 190-5 (1959) May. (In German)

For gas-cooled reactors two thermodynamic cycles working according to different principles are used, the direct single loop and the two circuit system with indirect heat addition to the working medium. The direct closed cycle gas turbine circulates the cooling medium through the heat source without additional losses and without the need for external pumping power. For the two loop cycle various possibilities for the circuit exist. Some of these cycles with their losses are compared with the single loop giving results as follows: The pumping power needed for a primary cycle is found to be in the range of 8 to 22% of the useful output. With a turbine in the primary cycle driving the circulation-compressor, losses of approx. 10% have to be expected, mainly due to the fact that the max. temperature in the working cycle is lower than the reactor outlet corresponding to the turbine expansion. A number of other diagrams allowing the working cycle to operate close to reactor-outlet temperature are discussed. The systems incorporating heat exchangers have smaller losses of approx. 5%. Some of the new schemes are only applicable with steam generating plants. (auth)

17318

RECENT PROJECTS ON REACTORS WITH GASEOUS COOLANT. W. Klieforth. Atomkernenergie 4, 196-201(1959) May. (In German)

The significance of the gas cooled nuclear reactor in the programs of the UK, US, and German Federal Republic is described. Two types of major importance in the UK are treated more in detail, namely the Advanced Gas-Cooled Reactor with enriched uranium and CO_2 as coolant and the High-Temperature-Gas-Cooled Reactor for temperatures up to 750°C with helium as coolant. This prototype for the investigation of the uranium-thorium cycle will be developed within the OEEC as the "Dragon" project. From the U.S. program the high temperature reactor of General Dynamics Co. with temperatures up to 540°C and a pressure of 100 ata is discussed. The advantages of the use of enriched uranium and the influence of plutonium within the fuel elements are considered. The coolant is helium. A further U.S. development with enriched uranium and helium as coolant is pursued by the Oak Ridge National Laboratory together with Kaiser Engineers and ACF-Industries. The German project concerns a 15 Mwe high temperature reactor. Also, the uranium–thorium cycle is investigated. (auth)

17319

INSTALLATION FOR THE AUXILIARY COOLING OF REACTORS. Hans-Richard Meininghaus. Atomkernenergie 4, 232-4(1959) June. (In German)

The heat production from neutron flux and radioactive radiation after the shut down of the reactor is so substantial that the cooling of the reactor must be continued. Since, however, conditions are imaginable in which reactor cooling by means of the main cycle is no longer possible, an auxiliary cycle is provided. The design of this cycle together with its further range of applicability is described. (auth)

17320

THE PRESENT STATE OF DEVELOPMENT OF GAS COOLED REACTORS FOR HIGH TEMPERATURES. A. Thiel. Atomkernenergie 4, 241-4(1959) June. (In German)

The development of gas cooled reactors is briefly reviewed, and the problems which oppose the achievement of high temperatures are indicated. Some proposals to overcome these difficulties are discussed. (auth)

17321

FUEL ELEMENTS FOR GAS COOLED REACTORS. M. Becker. Atomkernenergie 4, 244-7(1959) June. (In German)

The high gas temperatures planned for future gas-cooled power reactors make the development of new types of fuels necessary. Only a slight increase in temperature would be expected in the transition from uranium fuel rods to uranium tubes or plates. The transition to ceramic fuels offers the possibility of a greater temperature increase. The canning materials must have sufficient high-temperature strength and corrosion resistance. The metals and ceramic materials with these properties are discussed. For the highest temperatures, graphite is probably most suitable. (auth)

17322

PROPOSED YANKEE REACTOR DECONTAMINATION SYSTEM. R. M. Watkins and A. M. Potesta (Westinghouse Electric Corp., Pittsburgh). Nuclear Sci. and Eng. 2, No. 1, Suppl., 13(1959) June.

The function of the system is removal of radioactive fission and corrosion products from the internal surfaces of components, piping, and fittings of any loop of the main coolant system. This is achieved by supplying two separate decontamination solutions (3 wt.% $KMnO_4$–10 wt.% NaOH and 10 wt.% ammonium citrate) to any isolated loop. Levels of 5×10^6 Mev cm^{-2} sec^{-1} can be reduced enough to permit maintenance access. (W.D.M.)

17323

THE PREDICTION OF STEAM VOLUME FRACTIONS IN BOILING SYSTEMS. J. F. Marcheterre and M. Petrick (Argonne National Lab., Lemont, Ill.). Nuclear Sci. and Eng. 2, No. 1, Suppl., 13-14(1959) June.

The data and working curves used at ANL for the prediction of the density of steam–water mixtures are summarized and compared with the results of other investigators. The local steam volume fraction is a function of bulk water temperature, velocity, heat flux, pressure, and channel dimensions. Limited results are presented, but there is as yet no adequate means of prediction for the range of operation of most boiling reactors. (W.D.M.)

17324

CORE CHARACTERISTICS OF FOUR ARMY PACKAGE POWER REACTORS. J. G. Gallagher, M. J. Leibson and B. J. Burne (Alco Products, Inc., Schenectady, N. Y.). Nuclear Sci. and Eng. 2, No. 1, Suppl., 15(1959) June.

The core characteristics of four Army Package Power Reactors (APPR-1, APPR-1A, APPR-1B, and Skid Mounted APPR) are presented and compared. This family of reactors employs stainless steel plate-type fuel elements. The core characteristics are predicted on the basis of modified two-group theory. The cal-

culated control rod bank positions and reactivity are compared with measurements taken during the burnout of APPR-1 Core 1. (W.D.M.)

17325

MEASUREMENT OF FUEL PLATE SURFACE TEMPERATURES IN THE ORGANIC MODERATED REACTOR EXPERIMENT. S. Sudar (Atomics International Div., North American Aviation, Inc., Canoga Park, Calif.). Nuclear Sci. and Eng. 2, No. 1, Suppl., 16(1959) June.

The OMRE uses fuel elements consisting of plates of a fully enriched UO_2 stainless steel cermet clad with stainless steel. The surface temperatures are measured with 36-gage chromel–alumel thermocouples spot welded to the cladding. The error in the measurement introduced by conduction along the thermocouple lead wires and convection to the coolant is discussed. (W.D.M.)

17326

A UNITIZED MAGNETIC-JACK CONTROL ROD. J. D. Howell and C. C. Weeks (Atomics International Div., North American Aviation, Inc., Canoga Park, Calif.). Nuclear Sci. and Eng. 2, No. 1, Suppl., 16-17(1959) June.

The "Unitized Magnetic-Jack Control Rod" is a single unit consisting of a control rod, magnetic-jack drive, and position indicator for use in an organic-cooled and -moderated reactor. It is designed to be inserted in an empty fuel channel and operated while immersed in organic coolant at temperatures up to 600°F The magnetic jack can be operated with a quick-setback circuit, allowing it to be dropped several inches for each actuation. (W.D.M.)

17327

THE DEVELOPMENT AND OPERATION OF CENTRIFUGAL PUMPS FOR LIQUID METALS AND FUSED SALTS AT 1100-1500°F. W. F. Boudreau, A. G. Grindell, and H. W. Savage (Oak Ridge National Lab., Tenn.). Nuclear Sci. and Eng. 2, No. 1, Suppl., 17-18 (1959) June.

Four centrifugal pumps developed at ORNL for circulating Na, NaK, and molten salts at temperatures up to 1500°F are described. The pumps were built with capacities of 5-6, 60-150, 500-700, and 1200-1500 gpm. The design heads range from 40 to 375 ft. All are sump type pumps, and they utilize centrifugal impellers and volutes of conventional geometric design. A vertical pump shaft with the impeller overhung at the lower end is supported in a nearly conventional bearing housing. Drive motors are located above or at one side and external to the bearing housing. (W.D.M.)

17328

ENGINEERING DEVELOPMENT OF THE PWR CORE AND VESSEL. N. J. Palladino, J. J. Brennan, S. Cerni, L. Porse, and J. Sherman (Westinghouse Electric Corp., Pittsburgh). Nuclear Sci. and Eng. 2, No. 1, Suppl., 18-19(1959) June.

The solution of many design problems could not be established by analysis alone, so that testing was often required to establish a basis for proceeding with the design. Some of the details of typical tests and the scope of engineering information that was developed during the design of the PWR core and vessel are discussed. (W.D.M.)

17329

THERMAL STRESSES IN NUCLEAR-REACTOR VESSEL NOZZLES. Joseph S. Busch, A. J. Martenson, and S. W. Sinderson (Westinghouse Electric Corp., Pittsburgh) and C. F. Peck, Jr. (Cooper Union). Nuclear Sci. and Eng. 2, No. 1, Suppl., 20(1959) June.

A major design problem in reactors which use a heavy-walled core vessel is the study of the thermal shock imposed on this vessel by rapid temperature changes in the inlet temperature of the coolant. The thermal stress analysis of the nozzles of a large, heavy-walled, clad reactor vessel is discussed. Two cases are considered; decay heat removal after shutdown and small temperature differences at high flow rates and short times during normal operation. (W.D.M.)

17330

PRESTO—A PRESSURIZER TRANSIENT PROGRAM FOR THE IBM-704. J. P. Cunningham (Westinghouse Electric Corp., Pittsburgh). Nuclear Sci. and Eng. 2, No. 1, Suppl., 20-21(1959) June.

Due to necessary constraints on pressure, and to the influence of pressure on reactivity, adequate dynamic analysis of a pressurized water reactor system requires an accurate description of pressurizer transients. The number of phenomena present and the shortage of experimental data tend to weaken confidence in the validity of mathematical models amenable to hand or analogue computation. For this reason PRESTO, and IBM-704 digital computer program, was developed to represent complex pressurizer transients with a high degree of adaptability. The problem is explained and the variables noted. Computer time required for calculation is 1 sec per time step. (W.D.M.)

17331

RADIOCHEMICAL QUALIFICATION OF INCONEL FOR USE IN PRESSURIZED WATER REACTOR PRIMARY SYSTEMS. Y. Solomon and K. H. Vogel (Westinghouse Electric Corp., Pittsburgh). Nuclear Sci. and Eng. 2, No. 1, Suppl., 21-2(1959) June.

An in-pile, high-pressure, circulating water system (central thimble loop in NRX) was utilized to determine the effects of a change of structural materials external to the reactor on the amount and distribution of the radioactivities induced in the corrosion products from these materials. One-fourth of the inner surface of an austenitic stainless steel loop was replaced with Inconel. After 14 weeks operation the Inconel was removed, and the loop decontaminated to measure its radioactivity inventory. It was concluded that after five years operation the part-Inconel loop would be only 7% higher in activity than a comparable all-stainless loop. (W.D.M.)

17332

HIGH-FREQUENCY SURFACE THERMAL FATIGUE CYCLING OF INCONEL AT 1400°F. J. J. Keyes, Jr. and A. I. Krakoviak (Oak Ridge National Lab., Tenn.). Nuclear Sci. and Eng. 2, No. 1, Suppl., 22-4 (1959) June.

An investigation to ascertain experimentally the fatigue characteristics of a typical reactor structural alloy subjected to high-frequency surface thermal oscillations is described. The experimental thermal fatigue studies were carried out on Inconel test sections of approximately ½ in. inside diameter with varying wall thicknesses. A fused fluoride salt was circulated through the pipe at frequencies of 0.1 to 1.0 cps for the temperature gradient. The thermal pulse generator is described. (W.D.M.)

17333

SCREENING OF LIQUID METAL FUEL REACTOR MATERIALS AND ADDITIVES. A. L. Lowe, Jr. and E. J. Rozic, Jr. (Babcock and Wilcox). Nuclear Sci. and Eng. 2, No. 1, Suppl., 24-5(1959) June.

Because the liquid-bismuth system is susceptible to mass transfer, it was decided that the tilting capsule type of test would be best for a qualitative evaluation of the many variables to be studied. The tilting capsule used for these tests consisted of a 15-in. long, ¾-in. O.D., 2¼ Cr–1 Mo steel pipe capped at both ends. Test specimens of Mo–Ti, Ta, and Be were fastened at each end. The capsule was partially filled with the U–Bi solution containing the desired amounts of additives, Zr and Mg. A ΔT of 225°F was maintained between the ends. The necessity of Zr in the fuel solution as a corrosion inhibitor was verified. The effects of heat treatment and surface preparation on corrosion were studied. (W.D.M.)

17334

BEHAVIOR OF STRUCTURAL MATERIALS EXPOSED TO AN ORGANIC-MODERATED REACTOR ENVIRONMENT. N. J. Gioseffi and H. E. Kline (Atomics International Div., North American Aviation, Inc., Canoga Park, Calif.). Nuclear Sci. and Eng. 2, No. 1, Suppl., 25-6(1959) June.

The behavior of various structural materials in an organic-moderated and -cooled reactor was determined under realistic operating conditions. Tests were run in the OMRE operating at 6-Mwh. Two in-pile dummy fuel elements and an out-of-pile section of a bypass line were loaded with mechanical and corrosion test specimens. Tensile strength, yield strength, reduction in area, elongation, and impact were measured after exposure for specimens of 1020 carbon steel, 4130 alloy steel, 304 stainless steel, 304 stainless steel sensitized 2 hr at 1200°F, 410 stainless steel, aluminum, and magnesium. (W.D.M.)

17335

EFFECTS OF CONTAMINANTS OUTGASSED FROM GRAPHITE ON STRUCTURAL MATERIALS IN HIGH-TEMPERATURE GAS. J. H. Devan and A. M. Smith (Oak Ridge National Lab., Tenn.). Nuclear Sci. and Eng. 2, No. 1, Suppl., 26-7(1959) June.

Eleven experiments were conducted in each of two types of test facilities to provide preliminary data on graphite outgassing, the effects of the contaminants on the proposed materials of construction, and the need for contamination removal. The tests included seven low-pressure, low-velocity thermal-convection tests with AGOT or TSF grade graphite. The specimens of Cr–Mo steel, T-1 steel, stainless steel, Zr, Zr alloys, and Be were held for 100 hr at 500°F and then for 900 hr or longer at temperatures ranging from 1000 to 1400°F. (W.D.M.)

17336

MASS TRANSFER IN HIGH-TEMPERATURE SODIUM LOOPS. W. R. Holman (American Standard, Redwood City, Calif.). Nuclear Sci. and Eng. 2, No. 1, Suppl., 27-8(1959) June.

Mass transport of type 316 stainless steel in sodium was studied by measuring local mass transfer rates in five thermal-convection loops. The results indicated that the mass transfer coefficient for dissolution and that for deposition were approximately equal and suggested that the over-all rate of materials transport was controlled simultaneously by both a slow step in the dissolution process and an equally slow step in the deposition process. Mass transfer coefficients varied from 10^{-3} to 2×10^{-3} cm/month in the temperature range 1000 to 1600°F. (W.D.M.)

17337

EFFECTS OF GAMMA IRRADIATION ON A CONVENTIONAL BEARING HOUSING UTILIZING OIL LUBRICATION. D. L. Gray and A. G. Grindell (Oak Ridge National Lab., Tenn.). Nuclear Sci. and Eng. 2, No. 1, Suppl., 28-9(1959) June.

The test bearing housing operated in a gamma-irradiation facility in the MTR canal for a total of 6018 hr. The lower journal bearing, shaft seal, and seal-oil-leakage catch basin received an integrated gamma dose of 10^{10} r. The circulating oil, Gulfcrest 34, received a dose of about 2.4×10^{8} r. The changes in physical and chemical properties of the lubricant that occurred during the test are summarized. None of the changes in lubricant properties deleteriously affected operation of the bearing housing. The bearings and seals were clean and operable at the conclusion of the test. (W.D.M.)

17338

SOLID STATE ELECTROLYSIS OF YTTRIUM METAL. J. M. Williams and C. L. Huffine (General Electric Co., Cincinnati). Nuclear Sci. and Eng. 2, No. 1, Suppl., 29-31(1959) June.

A bar of commercially pure yttrium metal 16 in. long with a 12-in.-long ⅜-in. diam central test section was connected to water-cooled electrodes located in the vacuum chamber of an arc melting furnace. The bar was heated by direct current for various times. The results of oxygen and nitrogen analyses and of hardness tests at various points along the rod following a treatment of 2500°F for 200 hr are given. Yttrium, when subjected to an electric field under the conditions of solid state electrolysis, exhibits migration of interstitials, oxygen, and nitrogen to the anode and hydrogen to the cathode. This movement results in a reduction of interstitial impurities, particularly oxygen. (W.D.M.)

17339

PHASE INTERCEPT MEASUREMENTS FOR NEUTRON SELF-SHIELDING CALCULATIONS. R. J. Allio, P. A. Oldow, and M. Halperin (Knolls Atomic Power Lab., Schenectady, N. Y.). Nuclear Sci. and Eng. 2, No. 1, Suppl., 31-2(1959) June.

A method was developed for the rapid determination of parameters describing the distribution of dispersed phases in a solid matrix. The characteristic actually measured is the phase intercept value, defined as the relative fraction of a random line occupied by a given phase. The measurement method is essentially one of automated lineal analysis involving microdensitometer recordings of light transmitted by transparencies of photo-micrographs. Phase intercept measurements were made on specimens consisting of B_4C particles dispersed in a Zircaloy-2 matrix. Dispersions containing 3 to 22 vol. % of particles in sizes ranging from 10 to 250μ were investigated. (W.D.M.)

17340

TRANSMISSION OF MONOENERGETIC NEUTRONS AROUND A BEND IN A PIPE CARRYING A SCATTERING AND WEAKLY ABSORBING MEDIUM. H. E. Hungerford (Atomic Power Development Associates, Inc., Detroit). Nuclear Sci. and Eng. 2, No. 1, Suppl., 33-4(1959) June.

In many reactor systems cooled by molten sodium or other nonhydrogeneous materials, neutron leakage through the shield via the coolant pipes present a serious shielding problem. Elbows or bends within the shield complicate the picture and have not heretofore been formally treated. The diffusion equation is set up for a pipe bend and calculations of neutron flux and current distributions and neutron leakage were made for various pipe elbows. Sodium was taken as the fluid medium. (W.D.M.)

17341

IMPORTANCE SAMPLING IN MONTE CARLO CALCULATIONS OF THICK SHIELD PENETRATION. M. H. Kalos (Nuclear Development Corp. of America, White Plains, N. Y.). Nuclear Sci. and Eng. 2, No. 1, Suppl., 34-5(1959) June.

Monte Carlo solutions of the Boltzmann equation can be carried out with zero variance with the help of an important function which gives the expected score of a particle at P. A method is suggested for evaluating the normalizing integral. The penetrations of 8-Mev neutrons in finite slabs of hydrogen are calculated. The calculations yield fast neutron doses with a statistical error of about 10% and neutron spectra in 15 fast energy groups with an error up to about 20% through 180 relaxation lengths. (W.D.M.)

17342

SOME TECHNIQUES USED IN SHIELDING DESIGN FOR THE NUCLEAR MERCHANT SHIP REACTOR. D. W. Montgomery and W. R. Smith (Babcock and Wilcox). Nuclear Sci. and Eng. 2, No. 1, Suppl., 35-6(1959) June.

Calculations of the core-gamma flux and dose rates at the primary shield of the Nuclear Merchant Ship Reactor were performed using standard source, attenuation, and geometry techniques. The calculation of the secondary gamma flux was carried out by modifying the equation defining the uncollided gamma flux at the plane surface of an infinite slab shield. (W.D.M.)

17343

RADIATION LEVELS AND SHIELDING PERFORMANCE IN THE ARGONNE LOW POWER REACTOR. A. D. Rossin and P. G. Stoddart (Argonne National Lab., Lemont, Ill.). Nuclear Sci. and Eng. 2, No. 1, Suppl., 36-8(1959) June.

Observations were made of the radiation levels throughout the Argonne Low Power Reactor (ALPR) plant. Results of a study of the attenuation of neutrons in the main bulk gravel shield, made by irradiating gold foils in the experimental hole, are given. These results are compared with shielding design calculations. Routine radiation surveys were taken in the plant whenever the reactor was producing power and most of the levels are direct functions of the power levels. (W.D.M.)

17344

SHIELDING MEASUREMENTS AND ANALYSES PERFORMED DURING THE APPR-1 PROGRAM. S. S. Rosen (Alco Products, Inc., Schenectady, N. Y.). Nuclear Sci. and Eng. 2, No. 1, Suppl., 38-9(1959) June.

The neutron and gamma flux distributions through the primary shield of the APPR-1 were experimentally determined under full power operation. The gamma flux distribution was measured both during reactor operation and as a function of time after shutdown. A shielding code was written for the IBM 650 to calculate the operating and shutdown gamma flux distributions through the shield. The results of the code calculations are compared with the measured values to evaluate the code's accuracy. With proper selection of input parameters the code will also compute gamma heating rates in regions external to the core. (W.D.M.)

17345

SHIELDING DESIGN METHODS FOR ARGONAUT-TYPE REACTORS. John Fagan (Argonne National Lab., Lemont, Ill.). Nuclear Sci. and Eng. 2, No. 1, Suppl., 39-40(1959) June.

An engineering approach to shielding calculations is evaluated for two reactors, the Argonaut-I, operating at ANL, and the Geneva Argonaut reactor. The methods of calculation selected are such that hand calculations could provide resonable results in an acceptable length of time, although the IBM-704 was used for part of the calculations presented. Fast and thermal neutron fluxes throughout the shields and gamma-ray dose rates at the outside of the shield are calculated for a power level of 10 Mw. (W.D.M.)

17346

A COMPARISON OF EXPERIMENTAL FAST AND THERMAL FLUXES WITH ANALYTICAL PREDICTIONS THROUGH THE RADIAL SHIELD OF EBR-1. Larry M. Rentschler (Argonne National Lab., Lemont, Ill.). Nuclear Sci. and Eng. 2, No. 1, Suppl., 40-1 (1959) June.

An investigation performed to appraise the accuracy of the thermal neutron fluxes predicted by the use of removal theory is described. Analytical results are compared with experimental data measured previously in the radial shield of EBR-1. The thermal neutron flux distribution was calculated by two approaches. The first used removal cross sections to predict the fast flux which in turn determined the source term for the thermal diffusion equation. Second, an epithermal energy group was inserted which had as its source the fast neutron flux multiplied by the removal cross section. This epithermal flux described the thermal neutron source. (W.D.M.)

17347

CLAD TITANIUM-BASE DISPERSIONS CONTAINING BORON. E. S. Byron, F. O. Von Plinsky, and S. W. Porembka (Westinghouse Electric Corp., Pittsburgh). Nuclear Sci. and Eng. 2, No. 1, Suppl., 42-3(1959) June.

A study was undertaken to evaluate Zircaloy-2 clad titanium-base dispersions containing enriched boron or enriched titanium diboride as possible control materials. Results of corrosion tests on 2.43 wt. % B^{10} and 8 wt. % TiB_2^{10} dispersions in titanium in the unclad and unirradiated condition are given. The specimens both clad and unclad were irradiated and results are given. Titanium-base dispersions containing 5 wt. % B^{10} or 34 wt. % TiB_2^{10} were clad with 0.045 and 0.060 in., respectively, of Zircaloy-2 and irradiated in NaK-filled capsules. (W.D.M.)

17348

IRRADIATION OF URANIUM MONOCARBIDE. F. A. Rough, A. W. Hare, R. B. Price, and S. Alfant (Battelle Memorial Inst., Columbus, Ohio). Nuclear Sci. and Eng. 2, No. 1, Suppl., 43-4(1959) June.

Cast uranium carbide containing carbon slightly in excess of stoichiometric UC was irradiated up to 5000 Mwd/ton to evaluate it as a fuel material for the SRE. The samples, prepared by an arc-melting technique, contained 5 wt. % carbon. Samples prepared in this

manner approached theoretical density for the given composition, and in the as-cast condition at 5 wt. % C, containing UC_2 as a second phase. Samples were irradiated to about 700 Mwd/ton at 600°F maximum fuel center temperature, 1420 Mwd/ton at 1600°F, and to about 5000 Mwd/ton at 1830°F. (W.D.M.)

17349

FISSION-FRAGMENT IMPACT TRAPPING BY ThO_2 SLURRY PARTICLES. Donald G. Gardner (Westinghouse Electric Corp., Pittsburgh). Nuclear Sci. and Eng. 2, No. 1, Suppl., 45-6(1959) June.

In a homogeneous reactor of the Th–U–O aqueous-slurry type, a major problem is the removal of the fission products which tend to act as neutron poisons. Fragments which come to rest with a slurry particle may be quite difficult to remove unless the slurry particles are completely dissolved. In order to judge the potential value of certain slurry purification methods, it is necessary to estimate the percentage of fission fragments that might become lodged with the slurry particles. Some simplifying approximations are made as to the ways in which a fragment can come to rest in a particle and three types of particles are considered, large, small, and intermediate. (W.D.M.)

17350

THE REACTION AND GROWTH OF URANIUM DIOXIDE–ALUMINUM FUEL PLATES AND COMPACTS. R. C. Waugh (Oak Ridge National Lab., Tenn.). Nuclear Sci. and Eng. 2, No. 1, Suppl., 46(1959) June.

The reaction of dispersed UO_2 in an aluminum matrix in pressed compacts and fuel plates was studied at 500 to 600°C. Correlation of reaction with the accompanying volume increase was made and a growth mechanism proposed. (W.D.M.)

17351

SOME MATERIAL PROBLEMS IN OPERATING A METAL-CLAD URANIUM-DIOXIDE FUEL ELEMENT ABOVE 1200°F. J. W. Woods and D. A. Douglas (Oak Ridge National Lab., Tenn.). Nuclear Sci. and Eng. 2, No. 1, Suppl., 46-7(1959) June.

For operation at temperatures above 1200°F a ceramic type fuel such as UO_2 is needed. Since it is desirable that the external coolant system be free of fission product activity, a metal capsule around the fissionable material is necessary. Stainless steel is the only presently acceptable material for this purpose. Three mechanisms for failure of the metal capsule are described, and possible solutions to these problems are suggested. Mechanisms investigated were (1) buckling of the capsule against the fuel, (2) bursting of the capsule as a result of an internal buildup in pressure, and (3) bowing or warping of the fuel elements produced by nonisothermal temperature distributions which reduce the spacing between tubes. (W.D.M.)

17352

FABRICATION OF FUEL ELEMENTS FOR THE TRANSIENT REACTOR TEST. C. H. Bean, F. D. McCuaig, and J. H. Handwerk (Argonne National Lab., Lemont, Ill.). Nuclear Sci. and Eng. 2, No. 1, Suppl., 47-8(1959) June.

The fuel elements for the Transient Reactor Test (TREAT) consist of approximately 4-in.-square graphite–U_3O_8 fuel blocks in 4-ft-long vacuum-sealed Zircaloy-3 cans riveted to a 24-in.-long aluminum jacketed graphite reflector at each end. The fuel blocks are a dispersion of U_3O_8 in graphite with a C-U^{235} ratio of about 10,000 to 1. Fabrication of the fuel blocks is described and thermal outgassing studies are reported. Fabrication and loading of the Zircaloy-3 cans are discussed. (W.D.M.)

17353

PROGRESS REPORT ON FUEL ELEMENT DEVELOPMENT STUDIES AT THE MATERIALS TESTING REACTOR. W. C. Francis and J. M. Waage (Phillips Petroleum Co., Idaho Falls, Idaho). Nuclear Sci. and Eng. 2, No. 1, Suppl., 48-9(1959) June.

Early in the operational stages of the MTR, a program was initiated for the development of long-life fuel assemblies, and the performance improvement of MTR-ETR type fuel elements, with the ultimate goal of reducing operating costs. For the realization of the objectives, the program has embraced a study of various fuel compositions and enrichments, claddings, burnable poisons, non-uniform fuel and poison distributions, and fuel arrangement permitting high power operation with improved performance. The bulk of the materials study was performed by the use of sample plates containing selected fuel and poison compositions. (W.D.M.)

17354

SODIUM REACTOR EXPERIMENT FUEL ELEMENT EXPERIENCE. B. R. Hayward (Atomics International Div., North American Aviation, Inc., Canoga Park, Calif.). Nuclear Sci. and Eng. 2, No. 1, Suppl., 49-50 (1959) June.

The SRE fuel elements consist of seven rods assembled as a cluster. Each rod contains a series of 6-in.-long by 0.750-in.-diam slugs bonded with NaK in a sealed, thin-walled, type 304 stainless steel tube. The standard fuel is unalloyed alpha-rolled beta-treated U. Four standard SRE rods were examined at nominal burnups of 50, 80, 400, and 850 Mwd/t. Non-destructive examinations consisted of external dimensional measurements in the SRE hot cell and televised observations inside the shielded cask during removal from the reactor. (W.D.M.)

17355

A METHOD OF CORRELATING IRRADIATION EFFECTS IN DISPERSION FUELS. D. L. Keller, L. E. Hulbert, and B. W. Dunnington (Battelle Memorial Inst., Columbus, Ohio). Nuclear Sci. and Eng. 2, No. 1, Suppl., 50-1(1959) June.

A necessary part of the development of dispersion-type fuel elements is an understanding of the correlation of irradiation effects with fuel characteristics and irradiation conditions. Using the assumption that dispersion elements fail by plastic deformation and fracture of the metal matrix, due to pressure from the fission gases, appropriate mathematical correlations are developed. Two separate analyses are given, one for creep and one for simple yielding. (W.D.M.)

17356

LONG-TERM NUCLEAR PERFORMANCE OF TYPICAL MOLTEN-SALT REACTORS. Lloyd G. Alexander and J. W. Miller (Oak Ridge National Lab., Tenn.). Nuclear Sci. and Eng. 2, No. 1, Suppl., 51-2(1959) June.

Three methods of processing fuel from molten-salt reactors are discussed. The processes considered were "Fluorine Volatility," "HF Dissolution," and "Ion Exchange." The most advantageous processing method is that which results in the least value of the sum of fuel inventory and burnup charges and the low-

est capital and operating costs for the processing. The inventory and burnup in several reactors with processing at various rates are compared. The fuels considered are fluorides of Li, Be, Th, and U. (W.D.M.)

17357

NON-LINEAR DYNAMIC STABILITY OF A REACTOR WITH HEAT FLOW. W. K. Ergen (Oak Ridge National Lab., Tenn.). Nuclear Sci. and Eng. 2, No. 1, Suppl., 53(1959) June.

It is shown that heat conduction causes damping of the oscillations, if α is proportional to η, or to the power density, where $-\alpha(x)$ is the temperature coefficient of reactivity divided by the mean neutron life time, η is the fraction of power generated at x, and x is the space variable. (W.D.M.)

17358

VELOCITY-DEPENDENT NEUTRON TRANSPORT THEORY. W. R. Conkie (Atomic Energy of Canada, Ltd., Chalk River, Ont.). Nuclear Sci. and Eng. 2, No. 1, Suppl., 53-5(1959) June.

Little work has been done so far on the solution of multi-region problems in various geometries when the cross sections are allowed to vary with neutron velocity, but it is to be expected that the general form of the solutions should be similar in a spherical harmonics type of solution. As an example of this type of solution a P_1 spherical harmonics solution was obtained for the case of plane geometry and an ideal gas scatterer of unit mass. (W.D.M.)

17359

KLEIN-NISHINA PHOTON CROSS SECTIONS. Mary J. Stanley and Bernard H. Duane (General Electric Co., Cincinnati). Nuclear Sci. and Eng. 2, No. 1, Suppl., 55-6(1959) June.

As a first step in calculating gamma heating with S_n transport theory programs, Klein-Nishina photon cross sections for relativistic Compton scattering were computed by FORTRAN Program Gamma. Extensive compilations of Klein-Nishina photon cross sections for "straight-ahead" shielding calculations are available in the literature. However, no previous compilation was found of collision; zeroth, first, and second moment energy-transfer cross sections which were usable for isotropic or nearly isotropic photon scattering calculation in a reactor core. (W.D.M.)

17360

MULTI-GROUP EQUATIONS DERIVED FROM A VARIATIONAL PRINCIPLE. G. P. Calame and H. Brooks (Harvard Univ., Cambridge, Mass.). Nuclear Sci. and Eng. 2, No. 1, Suppl., 56-8(1959) June.

Approximate solutions to the age or Boltzmann equations may be obtained from the variational expressions by substituting appropriate trial functions into them and varying them. Multi-group equations have been obtained by the substitution of trial functions with specified lethargy variations but with unspecified spatial variations $\phi(\bar{r})$ and $\phi^+(\bar{r})$, by performing the lethargy integrations, and by requiring the resulting expression to be stationary with respect to arbitrary variations of ϕ and ϕ^+. (W.D.M.)

17361

VARIATIONAL ANALYSIS OF MULTI-DIMENSIONAL SYSTEMS. D. S. Selengut (General Electric Co., Richland, Wash.). Nuclear Sci. and Eng. 2, No. 1, Suppl., 58-9(1959) June.

The amount of computation involved in analyzing a given mathematical model of a reactor depends primarily upon the amount of information the computer must handle. A general procedure has been developed using variational methods for the systematic replacement of a complicated theory involving many independent variables by a simpler theory involving equations in fewer independent variables. It is shown that, given any system described by linear operator equations, an adjoint solution can be defined together with a Lagrangian functional whose stationary property is equivalent to the system equations. (W.D.M.)

17362

CHEMICAL BINDING EFFECTS IN NEUTRON THERMALIZATION. Noel Corngold (Brookhaven National Lab., Upton, N. Y.). Nuclear Sci. and Eng. 2, No. 1, Suppl., 59(1959) June.

In a previously reported analysis of the Boltzmann equation describing neutral thermalization in infinite homogeneous systems, the general method was illustrated by application to the simple model of a gas of point-particles. Additional results are presented which were obtained for systems exhibiting chemical binding. The principal result of the general analysis is a series expansion for the neutron flux equation. The series is evaluated for a proton bound in H_2O and beryllium. (W.D.M.)

17363

ARBITRARY ARRANGEMENT OF CONTROL ELEMENTS. Raymond L. Murray (North Carolina State Coll., Raleigh). Nuclear Sci. and Eng. 2, No. 1, Suppl., 60-1(1959) June.

The control of a reactor is often most conveniently accomplished by an array of absorbing elements of various sizes, compositions, and locations. As a simple example, the system may consist of a ring of identical shim rods plus regulating rods of lower reactivity value. During operation, one or more safety or control rods may be removed, leaving an asymmetric pattern. Criticality conditions for general configurations such as these in a bare equivalent cylindrical core are derived in the two-group model by an extension of an earlier work. (W.D.M.)

17364

MATERIAL BUCKLING MEASUREMENTS IN A SUBCRITICAL ASSEMBLY. Robert E. Uhrig (Iowa State Coll., Ames). Nuclear Sci. and Eng. 2, No. 1, Suppl., 61-2(1959) June.

A method is proposed for determining the inverse relaxation length and material buckling for a subcritical assembly. Values determined by this method and by the usual method are given. A BF_3 counter was used for flux measurements in both cases, and the standard deviation of the individual measurements varied between 0.2 and 0.9% of the count. (W.D.M.)

17365

NEUTRON MULTIPLICATION MEASUREMENTS OF HETEROGENEOUS 3.1 PER CENT ENRICHED URANIUM–WATER SYSTEMS. R. C. Lloyd, R. B. Smith, and E. D. Clayton (General Electric Co., Richland, Wash.). Nuclear Sci. and Eng. 2, No. 1, Suppl., 62-3(1959) June.

The design of efficient systems for processing spent power reactor fuel elements requires information on the critical masses involved. To obtain some of the needed information, approach-to-critical experiments were carried out with light-water-moderated and-

reflected hexagonal-lattice assemblies using enriched solid U fuel elements. Experiments were made for fuel elements of 0.925, 0.600, and 0.300-in. O.D. with the H_2O/U ratios for lattice spacings to span maximum buckling and minimum critical mass. (W.D.M.)

17366

PRESSURIZED FACILITY FOR SUBCRITICAL LATTICE MEASUREMENTS AT HIGH TEMPERATURES. E. J. Hennelly, T. F. Parkinson, and W. B. Rogers, Jr. (E. I. du Pont de Nemours and Co., Augusta, Ga.). Nuclear Sci. and Eng. 2, No. 1, Suppl., 64(1959) June.

For the study of power reactors moderated with heavy water, a pressurized subcritical experimental facility, the PSE, was installed at Savannah River, which makes it possible to obtain nuclear measurements in D_2O- or H_2O-moderated lattices at temperatures up to 215°C. The experimental lattices are supplied with neutrons from five retractable Sb-Be sources. The physical arrangement of the facility is described and some initial experiments are summarized. (W.D.M.)

17367

A NEW DESIGN FOR A WATER-MODERATED, SUBCRITICAL REACTOR. E. F. Leonard and C. J. Morrissey (Columbia Univ., New York) and C. Zucker (Fairleigh-Dickinson Univ., Rutherford, N. J.). Nuclear Sci. and Eng. 2, No. 1, Suppl., 64-6(1959) June.

The Columbia University variable-lattice, subcritical assembly is a natural-uranium, water-moderated reactor designed for teaching the principles of nuclear physics and engineering, and for graduate research. The distinguishing feature of this assembly is a lattice whose spacing is continuously variable between an upper limit (fixed by vessel size) and a lower limit (fixed by fuel-tube size). The design and physical arrangement are discussed. Preliminary results indicate that the optimum moderator-to-fuel ratio for the hollow, Savannah River-type fuel slug is approximately 2:1. (W.D.M.)

17368

A HOMOGENEOUS SUBCRITICAL ASSEMBLY. W. T. McIntosh (Lockheed Aircraft Corp.). Nuclear Sci. and Eng. 2, No. 1, Suppl., 66-7(1959) June.

A portable enriched homogeneous subcritical assembly was built for the University of Texas. The assembly was designed to allow expedient change of reflector media for use in student training in nuclear physics. The core consists of several 10-in.-diam disks of molded high strength polyethylene impregnated with a homogeneous dispersion of 20%-enriched UO_2. The cylindrical core is completely enclosed in a thin polyethylene jacket. The assembly core may easily be lifted by one man and is readily inserted into several different reflector units. (W.D.M.)

17369

NEUTRON FLUX DISTRIBUTIONS IN ORGANIC MODERATED REACTOR CORES. V. A. Swanson (Atomics International Div., North American Aviation, Inc., Canoga Park, Calif.). Nuclear Sci. and Eng. 2, No. 1, Suppl., 67(1959) June.

An experimental study was made of the neutron flux distributions in two uranium fueled organic moderated lattices placed on the thermal column of a water boiler reactor. The fuel elements consisted of either 10 or 12 1.875% enriched, Al-clad plates. The lattice under study had spacing of 6-in., and was held in a 4 ft diameter tank containing a terphenyl-diphenyl mixture at 27°C. Diffusion length, critical mass, and thermal utilization of the lattices were determined. (W.D.M.)

17370

k_∞ MEASUREMENTS OF 2 PER CENT U^{235} ENRICHED UF_4 IN PARAFFIN. V. I. Neeley (General Electric Co., Richland, Wash.). Nuclear Sci. and Eng. 2, No. 1, Suppl., 67-9(1959) June.

Values of k_∞ for low enriched materials are of interest in the processing and handling of power reactor fuels. An experiment to measure k_∞ in the cavity of the Physical Constants Testing Reactor is described. The value of k_∞ for 2% U^{235} enriched UF_4–paraffin systems at a hydrogen-to-U^{235} atomic ratio of 195 was found to be 1.216 ± 0.013. (W.D.M.)

17371

PULSED NEUTRON MEASUREMENTS ON PLEXIGLAS. K. W. Seeman (General Electric Co., Cincinnati). Nuclear Sci. and Eng. 2, No. 1, Suppl., 69-70(1959) June.

The thermal neutron macroscopic absorption cross section and diffusion constant of Plexiglas were measured by the pulsed neutron technique. The time decay of the fundamental mode of the thermal flux was determined for a series of cylinders having diameters ranging from 11 to 2.4 in. and geometrical bucklings from 0.04 to 0.7 cm^{-2}. The neutron-producing bremsstrahlung target was located at the center of one end of the cylinder, thus maintaining radial symmetry. Time decay measurements of the leakage flux were then made at two points on the side of the cylinder corresponding to both modes of the third axial harmonic. (W.D.M.)

17372

METHODS FOR THE CALCULATION OF CONVERGATRON SYSTEMS. Paul Michael and Lyle B. Borst (New York Univ.). Nuclear Sci. and Eng. 2, No. 1, Suppl., 70(1959) June.

In the direction of amplification, Convergatron stages consist of a moderating region followed by a fissioning region. Stages are separated by an absorber of thermal neutrons such as cadmium. The basic problem is to calculate the transmission of neutrons through the stage in each direction and to determine the over-all characteristics of coupled stages. The effective stage gain and the effective feedback factor are calculated from the properties of the individual stages by a modified double P_0 approximation to the transport equation with two energy groups. (W.D.M.)

17373

THE OAK RIDGE RESEARCH REACTOR: I. PREOPERATIONAL TESTS. F. T. Binford, C. D. Cagle, R. A. Costner, J. A. Cox, and W. H. Tabor (Oak Ridge National Lab., Tenn.). Nuclear Sci. and Eng. 2, No. 1, Suppl., 71-2(1959) June.

Preoperational testing of the ORR was started in Sept. 1957 and continued intermittently through June 1958. The total time consumed was about three months. Tests and measurements are described on coolant flow, building containment system, criticality, flux distribution, and boiling tests. (W.D.M.)

17374

THE OAK RIDGE RESEARCH REACTOR. II. OPERATIONAL PROBLEMS. W. H. Tabor, F. T. Binford, C. D. Cagle, R. A. Costner, and J. A. Cox (Oak Ridge

National Lab., Tenn.). Nuclear Sci. and Eng. 2, No. 1, Suppl., 72(1959) June.

Following preoperational testing of the ORR, several weeks were spent in shakedown operation at 20 Mw. During this time a number of unsatisfactory conditions were uncovered. The air-cooled main heat exchangers were found to be deficient in cooling capacity by about 25%. All the major water lines imbedded in concrete were found to be wet. A vacuum system was set up to dry them out and has continued in operation as a leak detector. Other problems discussed include control rod dropping, beam hole draining or filling during operation, and gaseous activity in the building. (W.D.M.)

17375

THE OAK RIDGE RESEARCH REACTOR: III. NORMAL OPERATION. J. A. Cox, F. T. Binford, C. D. Cagle, R. A. Costner, and W. H. Tabor (Oak Ridge National Lab., Tenn.). Nuclear Sci. and Eng. 2, No. 1, Suppl., 72-3(1959) June.

Regular operation of the ORR at 20 Mw on a routine basis began on July 20, 1958. The operation cycle consists of three weeks at full power followed by a one-week shutdown for experiment installation, general maintenance, and refueling. The core configuration currently in use contains 24 fuel elements and 4 control rods. The remaining 35 positions are occupied by Be reflector pieces or by experiments. Items discussed include core loadings, unscheduled shutdowns, cooling system operation, experiments, personnel, and operating costs. (W.D.M.)

17376

OPERATION OF THE MTR ON SPECIAL FUELS: TEST PROGRAM AND RESULTS. R. S. Marsden and D. R. deBoisblanc (Phillips Petroleum Co., Idaho Falls, Idaho). Nuclear Sci. and Eng. 2, No. 1, Suppl., 73-4(1959) June.

Fuel cores of uranium enriched to 20% in U^{235} and plutonium were evaluated in the MTR. The test methods and unpublished results are presented. The power is raised stepwise to 30 Mw, the heat-transfer limit, and operation continued for each core until shutdown by fuel depletion. The tests demonstrated the ability of both special fuels to withstand high-power, high-flux conditions. (W.D.M.)

17377

THE MIT NUCLEAR REACTOR STARTUP. E. Barnett, D. Lanning, E. Profio, D. Schwartz, and T. J. Thompson (Massachusetts Inst. of Tech., Cambridge). Nuclear Sci. and Eng. 2, No. 1, Suppl., 74-6(1959) June.

The MIT Reactor is heavy water cooled and moderated and operates at 1 Mw. The fuel loadings utilize highly enriched MTR-type fuel elements arranged in concentric rings about the central position. The fuel is contained in a 4-ft-diam. aluminum tank surrounded by a 2-ft layer of graphite. There is a 2-ft D_2O reflector above and below the core. The critical mass of the 19-element core consisting of 105-g elements was measured as 1950 g. Three other core configurations were studied. Initial operations at 1 Mw have shown that the temperature in the boral at the thermal shield is about 60°C. (W.D.M.)

17378

MEASURED REACTIVITY WORTHS OF MIT REACTOR COMPONENTS. C. Larson, D. Lanning, and T. J. Thompson (Massachusetts Inst. of Tech., Cambridge). Nuclear Sci. and Eng. 2, No. 1, Suppl., 76-7(1959) June.

Reactivity of regulating and shim-safety rods for cores 1 and 2 was measured. The worths of the single 105-, 162-, and 70-g elements were measured. The temperature coefficient of reactivity of the MITR was measured as -42 mβ/°C at 20°C, and -50 mβ/°C at 30°C. (W.D.M.)

17379

MEASURED MIT REACTOR NEUTRON FLUX DISTRIBUTIONS. R. L. Mathews, D. D. Lanning, and T. J. Thompson (Massachusetts Inst. of Tech., Cambridge). Nuclear Sci. and Eng. 2, No. 1, Suppl., 77-8(1959) June.

Flux measurements in the MITR core were made with cobalt and Formvar-covered copper wires. Cadmium ratios were determined for In, Cu, Au, and Co foils. Measurements were made in the moderator between elements as well as within the elements themselves. In the D_2O moderator the wires and strips of foils were suspended vertically from sets of collapsible Al arms attached to the fuel elements. Cadmium ratios taken at the center of the reactor in a voided thimble and disadvantage factors as measured by Cu wires suspended in and around the fuel elements are summarized. (W.D.M.)

17380

THE REACTIVITY WORTH OF THE UPPER REFLECTOR OF THE MIT REACTOR. Jeffery Lewins and T. J. Thompson (Massachusetts Inst. of Tech., Cambridge). Nuclear Sci. and Eng. 2, 78-9(1959) June.

The reactivity worth of the upper reflector of the MIT Reactor was estimated by a surface perturbation method and compared with the experimentally determined worth. Experimental determination of the worth of the upper reflector was made by a combination of period measurements and sub-critical multiplication measurements. (W.D.M.)

17381

RESONANCE ABSORPTION OF NEUTRONS IN A LUMP. K. Hasegawa (Oak Ridge National Lab., Tenn.). Nuclear Sci. and Eng. 2, No. 1, Suppl., 80-1(1959) June.

Resonance absorption of neutrons in a lump was calculated by two approximate methods: the narrow-resonance approximation and the wide-resonance approximation. A new resonance integral formula is proposed which tends to be equal to the results of the narrow resonance approximation in the narrow resonance limit. Resonance absorption of neutrons in a lump immersed in a strongly moderated infinite medium is considered. (W.D.M.)

17382

RESONANCE INTEGRALS FOR TIGHT LATTICES. Wolfgang Rothenstein (Brookhaven National Lab., Upton, N. Y.). Nuclear Sci. and Eng. 2, No. 1, Suppl., 81-2(1959) June.

Resonance integrals for closely packed lattices of U^{238} rods in water were calculated by solving the coupled integral equations for the collision densities in the fuel and moderator by successive approximations. The error in the resonance integrals arising from the inadequacy of the simple (Wigner) formulas for the single-flight collision probabilities was investigated. Calculated results are given for hexagonal lattices of 0.6 in. diam. U^{238} rods in water at 300°K, at different water-to-metal volume ratios. (W.D.M.)

17383

DANCOFF CORRECTION TO SURFACE RESONANCE ABSORPTION. R. J. French and V. Namias (Westing-

house Electric Corp., Pittsburgh). Nuclear Sci. and Eng. 2, 82-3(1959) June.

The Dancoff correction may be expressed in the form of a double integral over the azimuthal angles of the two cylinders where the limits of integration on one of the azimuthal angles assumes a different functional expression according to the value taken by the other angle. The first step in the simplification of the problem is the reduction of the problem to one of several integrations which are each dependent on only one parameter. This may be done by the use of a suitable Taylor expansion. The problem then becomes one of the integration of four separate double integrals. (W.D.M.)

17384

THE VARIATIONAL FORMULATION OF RESONANCE CAPTURE IN HOMOGENEOUS SYSTEMS. Robert Schermer and Noel Corngold (Brookhaven National Lab., Upton, N. Y.). Nuclear Sci. and Eng. 2, No. 1, Suppl., 83-4(1959) June.

Simple but accurate trial functions and representative profiles for $g_s(\mu)$ are used to obtain analytical results for resonance in mixtures. Capture probabilities are obtained for (1) isolated resonances, which may be compared with the conventional narrow-resonance and infinite-absorber approximations, and (2) for pairs of close-lying resonances, for which interference effects are significant. (W.D.M.)

17385

THE EFFECT OF SMALL INHOMOGENEITIES ON RESONANCE ABSORPTION. L. W. Nordheim and J. B. Sampson (General Atomic Div., General Dynamics Corp., San Diego, Calif.). Nuclear Sci. and Eng. 2, No. 1, Suppl., 84-5(1959) June.

A simple, approximate evaluation of resonance absorption can be obtained by using an extension of the equivalence theorem between homogeneous and heterogeneous assemblies. A new proof for this relation is given directly from the integral equation for the flux in the absorber. The only assumptions made are flat flux in the moderator and the rational Wigner approximation for the escape probability from the lumps. (W.D.M.)

17386

RESONANCE INTEGRALS IN LATTICES. Melvin M. Levine (Babcock and Wilcox). Nuclear Sci. and Eng. 2, No. 1, Suppl., 85-6(1959) June.

Through use of Dancoff corrections it is possible to make direct comparisons of resonance integrals measured in lattices with those measured for single lumps. The method of comparison allows useful conclusions to be drawn concerning the relations between Doppler effects in lattices and those in single lumps. (W.D.M.)

17387

RESONANCE ESCAPE PROBABILITY CALCULATIONS IN NONUNIFORM LATTICE ARRAYS. R. S. Wick (Westinghouse Electric Corp., Pittsburgh). Nuclear Sci. and Eng. 2, No. 1, Suppl., 86-7(1959) June.

The thin-resonance theory of Stein for an infinite array of fuel plates moderated by water was extended to handle nonuniform arrays of fuel plates, or any resonance absorber, typical of that likely to be found in an actual reactor. Examination of a one-dimensional design approximation shows that the type of resonance-escape-probability calculations generally used for design purposes bracket the results of the nonuniform lattice theory. (W.D.M.)

17388

ANALYTIC SOLUTION OF THE STEADY-STATE WAVE EQUATION WITH AN APPLICATION TO PARTIALLY-INSERTED CONTROL ROD THEORY. E. J. Betinis (Argonne National Lab., Lemont, Ill.). Nuclear Sci. and Eng. 2, No. 1, Suppl., 87-9(1959) June.

As an extension of previous work by the author, an eigenfunction expansion is developed as the solution of $\nabla^2 \phi + \Lambda\phi = 0$ in G, subject to the boundary condition $\phi|_\Gamma = 0$, where G is some domain with a surface Γ. IBM-704 calculations showed good agreement with other cases found in the literature. Calculations for one and two partially inserted off-center rods were made. (W.D.M.)

17389

THE EFFECTS OF INTERNAL HEAT GENERATION ON HEAT TRANSFER IN THIN FINS. W. S. Minkler and W. T. Rouleau (Carnegie Inst. of Tech., Pittsburgh). Nuclear Sci. and Eng. 2, No. 1, Suppl., 89-90(1959) June.

Classical thin fin theory is extended to include the effects of internal heat generation in the fins, as would be present if the fins were used on reactor fuel elements. Fins with and without fuel are considered. The theory developed should also be useful in determining temperature distributions in thin fin-type supports used to hold fuel element bundles together. (W.D.M.)

17390

THE INTERNAL DYNAMICS OF LARGE REACTORS IN A LINEAR TREATMENT. E. S. Beckjord and W. H. Harker (General Electric Co., Cincinnati). Nuclear Sci. and Eng. 2, No. 1, Suppl., 90-1(1959) June.

The core structure of large power reactors is usually divided into many smaller integral sections by the coolant flow channels. The dynamic and stability characteristics of such a core ensemble are related to the characteristics of the individual flow sections which comprise the core. It is assumed that such elements or channels are internally coupled to other such elements within the core only through neutron interchange, each unit being thermally and hydraulically isolated within the core. It is further assumed that the total change of the phenomena of interest are small compared to their steady state values. (W.D.M.)

17391

TRANSIENT HEAT FLOW IN A SAFETY DEVICE TRIGGER ELEMENT. T. H. Springer (Atomics International Div., North American Aviation, Inc., Canoga Park, Calif.). Nuclear Sci. and Eng. 2, No. 1, Suppl., 92(1959) June.

A safety device is described that is based on the principle that a gas (BF_3) stored at high pressure in a small volume can be released upon the proper flux signal to occupy a larger volume at reduced pressure and thereby create a reactivity change by a factor of about three or more. The release of the BF_3 is accomplished by melting a fuse consisting of a solder plug surrounded by a $Cu-UO_2$ compact. The thermal relaxation time of the fuse is studied by the thin-slab approximation method. (W.D.M.)

17392

EXPERIMENTAL EVALUATION OF A CONCENTRIC CYLINDER, SPIRAL FLOW HEAT EXCHANGER. J. S. McDonald (Atomics International Div., North American Aviation, Inc., Canoga Park, Calif.). Nuclear Sci. and Eng. 2, No. 1, Suppl., 92-4(1959) June.

An experimental evaluation was made of a 100-kw model of a liquid metal heat exchanger of novel design to determine its applicability in sodium-cooled reactor system. The advantages of the unit are rugged construction, elimination of tube-tube sheet joint and associated thermal shock problems, and excellent probability that primary and secondary fluids will not come into contact. The unit is described and results are given for various tests performed on the heat transfer characteristics. (W.D.M.)

17393

FREQUENCY FUNCTIONS FOR PRODUCTS OF ENGINEERING HOT CHANNEL FACTORS. J. R. Parrette (Westinghouse Electric Corp., Pittsburgh). Nuclear Sci. and Eng. 2, No. 1, Suppl., 94(1959) June.

In the application of engineering hot channel factors to nuclear reactor thermal design an analysis of the likelihood of their occurrence is often required. The determination of the frequency function, $f(z)$, for z, the product of n variables $X_1, X_2, \ldots\ldots X_n$, is a basic part of such analyses. An alternative approach to the problem is proposed, which may be more efficient particularly for large n and analytically specified frequency functions. It is based on the use of the moments of the individual frequency functions. (W.D.M.)

17394

CORRELATION OF BURNOUT HEAT FLUX DATA AT 2000 PSIA. D. W. Bell (Combustion Engineering, Inc., New York). Nuclear Sci. and Eng. 2, No. 1, Suppl., 95-6(1959) June.

A correlation for burnout heat flux was developed for upflow of water in vertical rectangular channels at 2000 psia. While most of the existing burnout correlations predict that for a constant fluid enthalpy at the burnout point, the burnout heat flux increases with an increase in mass velocity, the proposed correlation exhibits a maximum in this function. The mass velocity at which this maximum occurs decreases with increasing fluid enthalpy. The correlation model was developed from graphical inspection of the available data. (W.D.M.)

17395

TEMPERATURE RESPONSE TO POWER OSCILLATIONS IN A SOLID FUEL REACTOR. Fred Storrer (Atomic Power Development Associates, Inc., Detroit). Nuclear Sci. and Eng. 2, No. 1, Suppl., 96-8(1959) June.

The coupled partial differential equations governing transient heat transfer in a reactor were solved for the case of oscillatory power variation, without making the usual assumption that the frequency is low enough (or the fuel element thin enough) so that the heat flux at the fuel-coolant interface is related to the local average fuel and coolant temperatures as in steady state. (W.D.M.)

17396

THE INERTIA TRANSIENT IN REACTOR DRAINING. David Burgreen (Nuclear Development Corp. of America, White Plains, N. Y.). Nuclear Sci. and Eng. 2, No. 1, Suppl., 98-9(1959) June.

The order of magnitude of time involved in reactor draining problems, arising from reactor control or reactor safety studies, requires that cognizance be taken of the inertia transient. The results presented have application in the design of reactor control or scramming systems which depend upon the draining of moderator or reflector liquid, and they may be of use in the evaluation of reactor hazards resulting from the loss of coolant or other reactor liquid. (W.D.M.)

17397

PRESSURIZED-WATER FLUIDIZED-BED REACTOR CONTROL SYSTEM. C. Boehmer and R. D. Caw (Martin Co., Baltimore). Nuclear Sci. and Eng. 2, No. 1, Suppl., 100-1(1959) June.

In a pressurized-water fluidized-bed reactor, the core is composed of pellets of UO_2 in a fluid state. The bed of pellets is expanded by the motion of the coolant to a volume greater than would be occupied if the coolant were stationary. A control system design utilizing the relationship between reactivity and coolant is discussed. An analog study was made to investigate the adequacy and stability of the control system. A heat transfer study and scram system design are described. (W.D.M.)

17398

INSTRUMENTATION OF THE ARGONNE LOW POWER REACTOR. H. H. Hooker (Argonne National Lab., Lemont, Ill.). Nuclear Sci. and Eng. 2, No. 1, Suppl., 101-2(1959) June.

Some of the unconventional aspects of the Argonne Low Power Reactor instrumentation and control are discussed. Items discussed are reactor water level transmitter, six neutron-sensitive instrumentation channels, and the automatic power level adjustor accommodating varying steam demands. (W.D.M.)

17399

INTERACTION EFFECTS OF CONTROL RODS AND BURNABLE POISON STRIPS IN THE ARGONNE LOW POWER REACTOR. David H. Shaftman (Argonne National Lab., Lemont, Ill.). Nuclear Sci. and Eng. 2, No. 1, Suppl., 102-3(1959) June.

In the early stages of the ALPR core design, it was intended that reactivity control by cross rods would be supplemented by B^{10} dispersed uniformly in the fuel meat. Because of difficulty in fabrication, it was decided to incorporate the B^{10} in thin Al–Ni strips that could be welded to one or both side plates of the fuel assemblies. Two different strips were fabricated, one containing 0.40 g of B^{10} and the other 0.50 g of B^{10}. A study is described on the amount of reactivity controlled by the poison strips as a function of the penetration depth of the control rod bank. (W.D.M.)

17400

MODIFIED ROD DROP EXPERIMENTS. S. Milani and C. J. Emert (Westinghouse Electric Corp., Pittsburgh). Nuclear Sci. and Eng. 2, No. 1, Suppl., 103(1959) June.

The chief difficulty in obtaining consistent shutdown values in rod drop experiments apparently results from a change in the shape of the flux after the rods are dropped. A method is described in which the influence of this flux shape change has been minimized. In this method all rods are dropped from the uniform critical bank height, and the measurements are made with a miniature counter placed in the rodded region of the core. In this case there is no radial change in the shape of the flux, and the axial change can be calculated. Experiments were performed on a core $21\frac{1}{4} \times 21\frac{1}{4} \times 48$ in. high containing 23.6 kg of U^{235} and having nine Cd–Ag cruciform control rods. (W.D.M.)

17401

THE APPROACH TO BURN-OUT POWER IN WATER-COOLED FUEL CHANNELS. R. I. Hodge (Atomic Energy of Canada, Ltd., Chalk River, Ont.). Nuclear Sci. and Eng. 2, No. 1, Suppl., 104-6(1959) June.

In research reactors such as NRU, where the proportion of the total reactor power developed in a given indi-

the toxicity, occupational hazards, and safety measures regarding beryllium and certain rocket propellants, chiefly boron compounds, are compiled. (J.E.D.)

16678 UCRL-8576

California. Univ., Berkeley. Lawrence Radiation Lab. BIOSYNTHESIS OF MORPHINE (thesis). Don Robert Baker. July 1959. 217p. Contract W-7405-eng-48. $2.50(OTS).

A study was made of the biosynthesis of morphine by the opium poppy, Papaver somniferum. The plants were grown in a chamber in an atmosphere of radioactive carbon dioxide. Extensive studies on the chemistry of morphinones are described. A literature survey was made of the paper chromatography of opium alkaloids. Two methods are described which were found to work very well. Methods are described for the determination of the specific activities of the morphine type alkaloids in photosynthetic products. Reaction mechanisms are discussed. (C.H.)

16679 AEC-tr-3732

EFFECT OF DOSE AND DOSE RATE OF X-RAYS AND HIGH-SPEED ELECTRONS ON THE FREQUENCY OF MITOSIS IN TISSUE CULTURE. H. Gartner and K. Peters. Translated for Los Alamos Scientific Lab. from Strahlentherapie 92, 555-62(1953). 7p. $1.80 (ph), $1.80(mf) JCL.

A dose dependence was demonstrated in radiation-induced suppression of mitosis in tissue cultures irradiated by x rays and by high-speed electrons. The doses employed varied between 250 and 4000 r at a dose rate of 1000 r/min. A comparison of the calculated time factors for x rays and electron beams showed that the effect of dose rate differed for the two types of radiation. Data are tabulated and discussed. (C.H.)

16680

EFFECTS OF SITE OF INJECTION AND RADIATION ON TOXICOLOGY OF DIDYMIUM NITRATE. G. S. Melville, Jr., T. P. Leffingwell, and G. L. Hartwig (Randolph AFB, Tex.). A.M.A. Arch. Ind. Health 20, 23-8(1959) July.

The rare-earth mixture known as didymium (as the nitrate) was administered to rats intraperitoneally, subcutaneously, and in wound implantation. Mortality and clinical sequelae were observed. When groups of these animals were subjected to 800 r of Co^{60} γ-irradiation, mortality was increased in all treatment groups. This increase was statistically significant in the intraperitoneal experiment, and the combined effect appears to be synergistic. (auth)

16681

THE DETERMINATION OF ALPHA ACTIVITY ASSOCIATED WITH SUB-MICROGRAM QUANTITIES OF ENRICHED URANIUM IN URINE. T. C. Whitson and T. Kwasnoski (Oak Ridge Gaseous Diffusion Plant, Tenn.). Am. Ind. Byg. Assoc. J. 20, 169-74(1959) June.

A procedure was developed for routine determination of alpha activity resulting from the presence of submicrogram quantities of enriched uranium in urine. Wet oxidation of the organic content, removal of the calcium, and two hours of electrodeposition were found necessary prior to the alpha counting. The method provides over 80% recovery of the alpha activity with a precision of about ± 0.8 counts/minute. (auth)

16682

RAPID DETERMINATION OF THE RADIOACTIVITY OF PROTEINS AND OF THE RELATIVE PROPORTIONS OF VARIOUS FRACTIONS OF RADIOACTIVE SUBSTANCES PRESENT IN LEAVES. Zh. A. Medvedev (K. A. Timiriazev Moscow Academy of Agriculture). Biochemistry (USSR) (English Translation) 23, 759-66 (1958) Nov.-Dec.

A new procedure is described, serving for the rapid assay of the specific radioactivity of leaf proteins, and for the estimation of the relative proportions of various fractions of radioactive substances present in leaves. The leaf is placed on a weighed sheet of filter paper, and struck by a spring-loaded piston; this squeezes out fluid, giving an imprint of the leaf. The imprint is treated with 10% trichloroacetic acid to fix proteins, water-soluble substances and lipids are removed by washing, and the sheet is dried and reweighed, giving the protein content of the imprint, which is calculated per unit area. The specific radioactivity of the protein is calculated from the results of measurements of the surface radioactivity of the imprints. The relative proportions of various radioactive fractions are evaluated without weighing the sheets, from measurements of surface activity of the imprints at various stages of their selective extraction with appropriate solvents. The method is quick and simple, and is applicable to mass serial determinations of specific activity of labelled substances, and of the relative proportions of such substances in the protoplasm of the leaf cells. (auth)

16683

THE ACTION OF IONIZING RADIATION ON SOME NONPROTEIN THIO-COMPOUNDS OF THE ANIMAL ORGANISM. M. B. Gintsburg (Ukrainain Sanitary Chemical Research Inst., Kiev). Biochemistry (USSR) (English Translation) 23, 795-9(1958) Nov.-Dec.

Coenzyme A activity in rat liver and brain in definite intervals after total irradiation decreases considerably compared to the normals. CoA activity in liver and brain of irradiated rats is more strongly inhibited by the action of thiol poisons than in the controls. The amount of glutathione in the liver of irradiated rats after 24 hours is somewhat increased. In all the intervals studied it is not changed in the brain. (auth)

16684

THE PROLIFERATION IN VITRO OF TISSUE TAKEN FROM TUBERS OF HELIANTHUS TUBEROSUS IRRADIATED WITH X-RAYS. Robert Jonard. Compt. rend. 248, 3603-5(1959) June 22. (In French)

The irradiation of tubers of Helianthus tuberosus (Jerusalem Artichoke) with x rays causes latent changes in their cells which are expressed later when one makes use of their tissues in an in vitro culture. (tr-auth)

16685

COMPARISON OF THE THERAPEUTIC EFFICIENCY OF HOMOLOGOUS AND HETEROLOGOUS EMBRYONIC HAEMATOPOIETIC CELLS ADMINISTERED TO LETHALLY IRRADIATED MICE. A. Lengerová (Czechoslovak Academy of Sciences, Prague). Folia Biol. (Prague) 5, 18-22(1959).

The author compares the long-term therapeutic effect of the intravenous administration of suspensions of homologous and heterologous embryonic liver cells to lethally irradiated mice. Rat embryonic liver cells did not have a favorable effect, and even hastened the death of irradiated recipients. The administration of a homologous suspension led to recovery of 62% of lethally irradiated mice, none of which died from the fourth week after exposure, i.e., during the period characteristic for delayed death. This result is in good agreement

The yield of an excursion in a fast reactor depends upon a number of parameters: reactivity inserted, prompt lifetime, the flux shape, equations of state in the core and blanket, etc. For a step input of excess reactivity, k_{max}, and prompt lifetime, l, the yield is a function of k^3_{max}/l, and the functional dependence is determined from the equation of state in the core and the flux shape in the reactor. Several sets of numerical computation using Ax-1 were performed in order to compare the results with predictions of Bethe and Tait. (W.D.M.)

17411

MEASUREMENT OF THE NEUTRON ENERGY SPECTRUM OF THE GENERAL ELECTRIC TEST REACTOR. C. J. McDole (U. S. Steel Corp., Kearny, N. J.) and E. R. Beever and J. Moteff (General Electric Co., Cincinnati). Nuclear Sci. and Eng. 2, No. 1, Suppl., 116-17(1959) June.

Measurements of the neutron energy spectrum in the General Electric Test Reactor were made using resonance and threshold detectors. The detectors were $\frac{5}{16}$ in. foils of Al, Cu, Fe, Mg, Mn–Cu–Co, Ni, P, Pu^{239}, NaCl, S, Th, U^{235}, and U^{238}. Data were taken at 54 different positions in the reactor. Representative samples of the data obtained are presented. (W.D.M.)

17412

CORE POWER VARIATION AND FUEL BURNUP IN THE ENGINEERING TEST REACTOR. L. J. Harrison (Phillips Petroleum Co., Idaho Falls, Idaho). Nuclear Sci. and Eng. 2, No. 1, Suppl., 117-18(1959) June.

A direct result of making extensive neutron flux measurements in the ETR was the possibility of calculating the time and position variation of the core power and the burnup of U^{235} in the core. These values were calculated for each of the sixteen control rod fuel sections and for each of the approximately fifty fuel assemblies in the core. (W.D.M.)

17413

DYNAMIC AND STATIC PARAMETERS OF THE AQUEOUS HOMOGENEOUS ARMOUR RESEARCH REACTOR. C. W. Terrell and W. N. McElroy (Armour Research Foundation, Chicago). Nuclear Sci. and Eng. 2, No. 1, Suppl., 118-19(1959) June.

A brief description of the aqueous homogeneous Armour Research Reactor is given. The negative reactivity coefficient resulting from a temperature increase was determined over a fuel temperature range of 37 to 150°F. Possession of an accurately calibrated rod and temperature coefficient permitted a direct measurement of the void coefficient. The reactor was taken to different power levels, and from the calibrated rod the total reduction in excess reactivity was obtained. During the power increase program additional U^{235} and water were added to the core to determine the worth of U^{235} and water. (W.D.M.)

17414

PHYSICS STUDIES ON THE NEUTRON SOURCE REACTOR. J. M. Hendrie and J. P. Phelps (Brookhaven National Lab., Upton, N. Y.). Nuclear Sci. and Eng. 2, No. 1, Suppl., 119-20(1959) June.

The results of physics measurements on the Neutron Source Reactor made during start-up experiments are reported. This reactor is a graphite-reflected, water-moderated and -cooled, enriched uranium fueled system which has been operated in connection with the LMFR exponential experiments for more than a year. Measurements described include thermal flux, rod calibration, temperature coefficient of reactivity, and fuel element reactivity worth. (W.D.M.)

17415

PRELIMINARY THEORETICAL STUDIES OF THE BROOKHAVEN BEAM RESEARCH REACTOR. Paul Michael and Wolfgang Rothenstein (Brookhaven National Lab., Upton, N. Y.). Nuclear Sci. and Eng. 2, No. 1, Suppl., 120-1(1959) June.

The purpose of the BBRR is to provide intense thermal and epithermal neutron beams for fundamental physics research. The core consists of plate-type fuel elements cooled by heavy water. D_2O age calculations made with the GNU code agreed with recent measurements to better than 5%. A survey of spherical clean critical configurations for the BBRR was made for three D/U^{235} atomic ratios (330, 185, and 110). Temperature coefficient of reactivity was determined to be -3×10^{-4} per °C. (W.D.M.)

17416

HIGH FLUX ISOTOPE REACTOR. R. D. Cheverton (Oak Ridge National Lab., Tenn.). Nuclear Sci. and Eng. 2, No. 1, Suppl., 121-2(1959) June.

A comparison of possible types of reactors for the production of transplutonium elements and other isotopes indicates that a flux-trap reactor consisting of a beryllium-reflected, light-water-cooled annular fuel region surrounding a light-water island provides the required thermal neutron fluxes (3×10^{15}) at minimum cost. The preliminary design of such a reactor was carried out on the basis of a parametric study of the effect of dimensions of the island and fuel region, size and weight of the sample of material to be irradiated, heat removal rates, and fuel loading on the achievable thermal neutron fluxes in the island and reflector. (W.D.M.)

17417

A UO_2–STAINLESS STEEL REACTOR FOR THE ORNL BULK SHIELDING FACILITY. E. G. Silver (Oak Ridge National Lab., Tenn.). Nuclear Sci. and Eng. 2, No. 1, Suppl., 122-3(1959) June.

The feasibility of substituting stainless steel for Al will soon be investigated at the ORNL Bulk Shielding Facility with a new UO_2–stainless steel core (BSR-II) now being fabricated. Deviations from the usual swimming pool design are discussed. Computations indicate that 6.02 kg of U^{235} will be required for the cold, clean critical mass. The control mechanism was investigated. A proposed series of tests in the SPERT-I Test Facility is described. (W.D.M.)

17418

CONVERTER TUBES AND INVERTED FLUX TRAPS. C. O. Muehlhause (National Bureau of Standards, Washington, D. C.). Nuclear Sci. and Eng. 2, No. 1, Suppl., 123-4(1959) June.

In measurements requiring fast neutron flux, fast flux space free of slow flux may be generated inside a heavily loaded cylindrical fuel element which is essentially black to thermal neutrons. Two types are considered. Type I is designed to be placed in the core or reflector of a typical research reactor and acts as a fast neutron converter tube. Type II is designed to act as a reactor itself (the Inverted Flux Trap) when placed in an appropriate moderator. In both types the cylindrical structure consists of 2 or 3 closely spaced concentric fuel tubes to provide adequate heat transfer surface, and an inner concentric tube of Boral to prevent thermal neutrons from reaching the inner fast flux region which contains no moderator material other than the sample. (W.D.M.)

17419

LABORATORY ACCELERATOR NEUTRON SOURCE.

Charles H. Goldie (High Voltage Engineering Corp., Cambridge, Mass.). Nuclear Sci. and Eng. 2, No. 1, Suppl., 124(1959) June.

A moderate energy Van de Graaff accelerator was developed for use as a laboratory neutron source. The T(d,n) and D(d,n) reactions are used. Maximum performance of the accelerator is 150 μ amp continuous deuterium-ion beam at 400 kv. Tritium and deuterium absorbed in Ti have been used as targets. Total fast neutron output as a function of accelerator voltage was measured for both reactions with a BF_3 long counter, commercial fast neutron monitor, and sulfur activation. (W.D.M.)

17420

PARAMETRIC FUEL CYCLE COST STUDY FOR A LOW TEMPERATURE, 350 Mw REACTOR. J. D. Gylfe (Lockheed Aircraft Corp.). Nuclear Sci. and Eng. 2, No. 1, Suppl., 125-6(1959) June.

The minimum fuel cycle costs are estimated for a reactor to be used as a heat source in a sea water distillation cycle. The analysis is based on a 350 Mw, low temperature, pressurized light water reactor fueled with slightly enriched uranium. Preliminary design work on the reactor core was pursued to the extent necessary to provide a firm basis for the fuel cycle cost parameters. Specific power, initial reactivity, and H_2O to UO_2 volume ratios were taken as parameters in the investigation. (W.D.M.)

17421

FUSED OXIDE REACTOR FUELS. S. W. Mayer, W. S. Ginell, and D. E. McKenzie (Atomics International Div., North American Aviation, Inc., Canoga Park, Calif.). Nuclear Sci. and Eng. 2, No. 1, Suppl., 126-8(1959) June.

The present status and an outline of the work on an investigation of fused oxide fuels for power breeder reactors are given. The fuels, which consist of solutions of U and Th oxides in molten phosphates, have low vapor pressures, low solidification temperatures, and radiation damage resistance. The major component of the fuel is $NaPO_3$ which exists in the melt as long chains of oxygen-linked PO_4 tetrahedra. Several promising melt compositions are listed. Preliminary heat transfer calculations based on a cross flow, in-line tube bank heat exchanger for a 100 Mw reactor are summarized. Preliminary nuclear calculations were carried out on the basis of a $Th^{232}-U^{233}$ cycle for both a single region and a dual region reactor. (W.D.M.)

17422

FABRICATION OF THE NUCLEAR MERCHANT SHIP REACTOR CRITICAL EXPERIMENT FUEL RODS BY THE SWAGING PROCESS. L. R. Weissert, W. Markert, Jr., and V. J. Duplin, Jr. (Babcock and Wilcox Co.). Nuclear Sci. and Eng. 2, No. 1, Suppl., 128(1959) June.

The critical experiments supporting the design of the power plant of the N. S. Savannah required fuel rods of slightly enriched UO_2 clad in stainless steel tubing. The rotary swaging technique was selected as the reference fabrication process for the experimental rods. Processing of the UO_2 powder and fabrication of the rods are described. (W.D.M.)

17423

THE DEVELOPMENT AND MANUFACTURE OF HAFNIUM-ZIRCALOY CONTROL RODS. W. B. Haynes, J. C. Hill, and E. H. Sayell (Westinghouse Electric Corp., Pittsburgh). Nuclear Sci. and Eng. 2, No. 1, Suppl., 129(1959) June.

The development of manufacturing processes for hafnium-Zircaloy-2 control rods for use in water cooled nuclear reactors presents several problems due to the size and design of these components. The control rods are of cruciform cross section with a span of approximately 5 in. and vary in length from 56 to 124 in. Problems are discussed and rules for keeping repair costs down are listed. (W.D.M.)

17424

A NEW METHOD FOR THE FABRICATION OF DISPERSION-TYPE FUEL ELEMENT CORES. Henry H. Hausner. Nuclear Sci. and Eng. 2, No. 1, Suppl., 129-30 (1959) June.

The new method for the fabrication of dispersion-type fuel cores completely eliminates the application of pressure for compacting the powder mixture and, therefore, permits fabrication of considerably larger shapes which do not require as much elongation by rolling. The new method is a modification of the well-known ceramic process of "slip casting" and its application to metal powders and metal-ceramic combinations. Fabrication of UO_2-SS bars and plates is described. (W.D.M.)

17425

RECENT IMPROVEMENTS IN THE FABRICATION OF THE ISNSE ALUMINUM PLATE FUEL ELEMENT. J. Baird, R. Friddle, H. Bergua, and J. Diaz (Argonne National Lab., Lemont, Ill.). Nuclear Sci. and Eng. 2, No. 1, Suppl., 130-1(1959) June.

The core of the ISNSE element is a dispersion of U_3O_8 and aluminum powder clad in Al. The powders are mixed and pressed at 25,000 psi to form a compact. The compact is clad with molten Al and then hot rolled to specified thickness and trimmed to size. Recent developments investigated include preheating, use of UO_2, and Al-Si cladding. (W.D.M.)

17426

NON-OXIDE DISPERSION TYPE FUEL ELEMENTS. I. Sheinhartz (Sylvania-Corning Nuclear Corp., Bayside, N. Y.). Nuclear Sci. and Eng. 2, No. 1, Suppl., 131-2 (1959) June.

A series of dispersant type alloys was investigated to determine the feasibility of using the alloys as fuel elements. The dispersants investigated were UN, U_3Si_2, UC, and US. The matrix materials investigated were Al, Zircaloy-2, Mo, Nb, Nichrome V, Ti-Nb alloys, and V. Preparation of the dispersants is discussed and general observations are summarized. (W.D.M.)

17427

ULTRASONIC DISSOLUTION OF CANDIDATE FUEL ELEMENT CLADDINGS IN AQUEOUS REAGENTS. W. B. Tarpley, J. L. Straughn, and M. L. Bromberg (Aeroprojects, Inc., West Chester, Penna.). Nuclear Sci. and Eng. 2, No. 1, Suppl., 132-3(1959) June.

Specially designed magnetostrictive transducer-coupling systems were utilized to investigate the dissolution of Zircaloy-2, austenitic stainless steel, carburized stainless steel, and molybdenum in a variety of aqueous media. Ultrasonic energy was applied to samples by bulk liquid exposure, by close-proximity treatment, and by direct activation. The ultrasonic treatment effected significant increases in dissolution rates in certain media, as well as dissolution in media which ordinarily have little or no corrosive action on the specific materials. (W.D.M.)

17428

CALCULATION OF ISOTOPIC COMPOSITION OF NATURAL URANIUM FUEL IRRADIATED IN THE NRX

REACTOR. S. A. Kushneriuk (Atomic Energy of Canada, Ltd., Chalk River, Ont.). Nuclear Sci. and Eng. 2, No. 1, Suppl., 133-4(1959) June.

For purposes of comparison with, and analysis of, the experimental results, the isotopic composition of the NRX irradiated fuel and the relative reaction rates for neutron capture, fission, etc., in this fuel were calculated. The basis for the calculations is discussed. The particular comparisons with experiment which were carried out relate to the plutonium content in the fuel, the relative isotopic abundances of the Pu isotopes, the U^{235} burnup, and the shape of the 2200-m/sec neutron flux distribution. (W.D.M.)

17429

PARTIALLY FLAT RADIAL FLUX AND POWER WITH MINIMUM LEAKAGE. Roy Arthur Axford (Atomics International Div., North American Aviation, Inc., Canoga Park, Calif.). Nuclear Sci. and Eng. 2, No. 1, Suppl., 134-5(1959) June.

Non-uniform core loadings may be expected to yield a given degree of flux or power density flattening with a minimum amount of core fuel investment. For a specified degree of thermal neutron flux or power density flattening in a large core, the problem is to obtain the non-uniform core loading which achieves criticality with a minimum of neutron leakage from the core. Typical results of preliminary calculations are given for a 14-ft. diam. right cylindrical active core of a sodium-graphite-type reactor with an infinite radial reflector. (W.D.M.)

17430

ZIRCONIUM CROSS SECTIONS FOR REACTOR CALCULATIONS. W. Skolnik and N. C. Francis (Knolls Atomic Power Lab., Schenectady, N. Y.). Nuclear Sci. and Eng. 2, No. 1, Suppl., 135-6(1959) June.

It is shown that the use of realistic Zr cross sections in the calculations of the group constants, yields values of k_{eff} in substantial agreement with the Goldsmith predictions and experiments. A comparison of ages of Zr-H_2O mixtures was made between calculated and experimental results. A number of clean critical experiments were calculated in a few-group theory using the new Zr cross sections and the results are evaluated. (W.D.M.)

17431

SPATIAL DISTRIBUTIONS OF NEUTRON TEMPERATURES IN A MULTITEMPERATURE MODERATOR WITH VARIED ABSORPTION. D. R. Sawle and L. M. Grossman (Univ. of California, Berkeley). Nuclear Sci. and Eng. 2, No. 1, Suppl., 136-7(1959) June.

The neutron temperature is an important concept in the evaluation of the correct neutron cross section to be used in a thermal reactor and in reactor excursions. Since the neutron temperature can vary markedly throughout the reactor, it is important to know its spatial variation. A simple approach is proposed to the analysis of neutron temperatures and its application to the spatial variation problem is discussed. Several experiments are described which are planned to obtain a measure of the accuracy and the limitations of the approach. (W.D.M.)

17432

APPLICATION OF THE METHODS OF SYNTHETIC DESIGN TO k_{eff} STUDIES FOR FLUIDIZED BED REACTORS. C. Cyl-Champlin (Martin Co., Baltimore). Nuclear Sci. and Eng. 2, No. 1, Suppl., 137-9(1959) June.

The fitting of an empirical quadratic equation to k_{eff} in N dimensional phase space is accomplished through the use of synthetic design. This equation can in turn be evaluated at a number of points at a considerably lower cost than is entailed in solving the original equations. These methods were applied to the reactor analysis of a Fluidized Bed Reactor. Variations of k_{eff} as a function of several independent variables were studied for both water and organic cooled fluidized beds. (W.D.M.)

17433

SELECTION OF BURNABLE POISONS AND ZONE LOADINGS FOR OPTIMUM NUCLEAR DESIGN. J. E. Meyer and J. N. Grace (Westinghouse Electric Corp., Pittsburgh). Nuclear Sci. and Eng. 2, No. 1, Suppl., 139-40(1959) June.

The effect of zone loading of fuel and poison on the worth of control rods was studied. It is found that rod worth is improved if the rods are located in the central region of the core and if this region has a higher k_∞ than the unrodded regions of the core. The interaction between nonuniform depletion and activity mismatch was evaluated. Uniform (point-core) depletion calculations were performed to determine the amount of poison required at each time in life to match a given reactivity characteristic. (W.D.M.)

17434

TEMPERATURE COEFFICIENTS OF HIGHLY ENRICHED CORE IN SLAB GEOMETRY. S. L. Shufler, W. F. Vogelsang, R. S. Wick, and H. I. Dolnick (Westinghouse Electric Corp., Pittsburgh). Nuclear Sci. and Eng. 2, No. 1, Suppl., 140-2(1959) June.

Three calculational techniques were devised for the primary purpose of predicting the measured temperature coefficient of reactivity between 20 and 90°C of a highly enriched U-Zr-Al light water-moderated heterogeneous critical assembly with plate fuel elements in slab geometry. This very high leakage slab core with dimensions 7 × 30 × 54 in. and a metal to water volume ratio of 0.85, was controlled by three kinds of cruciform-shaped control rods: Cd-Ag, Cd-In-Ag, and Cd-stainless steel. The water-reflected seed slab had both a positive and negative temperature coefficient of reactivity in the range examined. (W.D.M.)

17435

A CORRELATION OF THE CRITICAL CONDITIONS FOR HOMOGENEOUS BARE REACTORS. Benjamin Pinkel and George B. W. Young (RAND Corp., Santa Monica, Calif.). Nuclear Sci. and Eng. 2, No. 1, Suppl., 142-4(1959) June.

A method of correlating the critical conditions of bare homogeneous reactors is presented. This method is applied to the results of an 18 group analysis for a series of bare, cold, homogeneous reactors comprised of pure U^{235} and the moderators H_2O, D_2O, LiH, Be, BeO, and C over a wide range of moderator to uranium mole ratios. The properties contained in the correlation parameters used are the buckling, the transport mean free path, the ratio of U^{235} volume to total reactor volume, the moderator thermal absorption cross section, the neutron energy degradation parameter, and the moderator to uranium mole ratio. (W.D.M.)

17436

SINGLE ELEMENT MEASUREMENTS. G. W. Rodeback, C. H. Skeen, and J. W. Zink (Atomics International Div., North American Aviation, Inc., Canoga Park, Calif.). Nuclear Sci. and Eng. 2, No. 1, Suppl., 144-5 (1959) June.

Suitable flux measurements about a single fuel element in a thermal column can be used to determine thermal blackness, epithermal blackness, and number of fission neutrons emitted per thermal neutron absorbed. Measurements were made with a single element of Th-7.6% of U(93% U^{235}) fuel consisting of a seven rod cluster of $^3/_4$-in. diam. slugs. Thermal and epithermal horizontal flux distributions were determined from the activations of bare and cadmium covered indium foils with a nominal spacing of 2 cm. (W.D.M.)

17437

THE DEPENDENCE OF ETA OF U^{233} ON NEUTRON SPECTRUM. J. Chernick and S. Oleksa Moore (Brookhaven National Lab., Upton, N. Y.). Nuclear Sci. and Eng. 2, No. 1, Suppl., 146(1959) June.

Two estimates of the variation of $\bar{\eta}$ with neutron spectrum were completed. In the first calculation, the resonance range was simply divided into two groups, one covering the important range from 1.5 to 3 ev with $\bar{\eta}$ taken as 2.00 ± 0.05. At higher energies the average value of η was estimated at 2.22 ± 0.05. In the second calculation, a large number of energy groups above 0.05 ev were considered. (W.D.M.)

17438

COMPARISON OF CRITICAL EXPERIMENTS FOR THE DETERMINATION OF ETA OF U^{233}. D. W. Magnuson and Reginald Gwin (Oak Ridge National Lab., Tenn.). Nuclear Sci. and Eng. 2, No. 1, Suppl., 146-8(1959) June.

The series of experiments to determine η of U^{233} with five concentrations of $U^{233}O_2(NO_3)_2$ solutions and four concentrations of $U^{235}O_2(NO_3)_2$ solutions in a 69.2-cm-diam. aluminum sphere is described. Boric acid was used as a poison in the experiments in order to vary the uranium concentration. Unpoisoned solutions in a 122-cm-diam. sphere were also made critical. Experiments and calculations are summarized. The best value of η determined was 2.295 ± 0.036. (W.D.M.)

17439

AGE TO INDIUM RESONANCE FOR D-D NEUTRONS IN HEAVY WATER. V. Spiegel, Jr. and A. C. B. Richardson (National Bureau of Standards, Washington, D. C.). Nuclear Sci. and Eng. 2, No. 1, Suppl., 148(1959) June.

An average age to indium resonance for 2 to 3 Mev neutrons from the D-D reaction at 250 kev was measured to be 116.8 cm^2 in heavy water. This age was determined by averaging the flux over the cosine of the angle by the Gauss integration procedure at 39.2, 90, and 140.8° for each root mean square distance from target to foil. A correction for absence of moderator in the beam duct was made. The experimental age before correction was 120.5 cm^2. (W.D.M.)

17440

DISCREPANCIES BETWEEN EXPERIMENTAL AND THEORETICAL AGES FOR Po-Be AND Ra-Be NEUTRONS IN WATER. D. Bogart, J. P. Cusick, and D. F. Shook (Lewis Flight Propulsion Lab., Cleveland). Nuclear Sci. and Eng. 2, No. 1, Suppl., 148-50(1959) June.

All methods for measuring neutron spectra, whether by nuclear emulsions, proton-recoil spectrometers, or scintillation spectrometer, have a lower limit of useful detection for neutron energies of about 1 Mev. The usual smooth extrapolations of spectra below measured energies have produced neutron yields of less than 10% below 1 Mev. In the present study, indirect experimental evidence was obtained for neutron yields of 30 to 40% below 1 Mev for the Po-Be spectrum, and 50 to 60% below 1 Mev for the Ra-Be spectrum. A comparison is presented of theoretical and experimental second moments for the spatial distribution of In resonance neutrons in C, Be, and H_2O, for the fission spectrum, the measured Po-Be and Ra-Be spectra, and the presently deduced Po-Be and Ra-Be spectra with the strong low energy components. (W.D.M.)

17441

THE USE OF GADOLINIUM AND SAMARIUM AS A MOCKUP OF XENON IN CRITICAL ASSEMBLIES. M. P. Cantwell, E. J. DeRoche, and R. C. Rohr (Knolls Atomic Power Lab., Schenectady, N. Y.). Nuclear Sci. and Eng. 2, No. 1, Suppl., 150-1(1959) June.

The problem of xenon poisoning in critical assembly studies of power reactor core life is considered. By analyzing the cross sections of several elements averaged over a Maxwellian spectrum, a mixture of Gd and Sm in the ratio of 4.38 by weight of oxide was found to match the Maxwellian averaged cross section of xenon over the entire thermal range from 0.02 to 0.24 ev. Sample compacts of the mixture and of the components separately in aluminum were prepared by powder metallurgy techniques. (W.D.M.)

17442

ELECTRICAL GENERATION BY DIRECT CONVERSION USING ISOTOPES. E. R. Ningard and H. O. Banks (Martin Co., Baltimore). Nuclear Sci. and Eng. 2, No. 1, Suppl., 151-2(1959) June.

Isotope-powered generators present an attractive method of converting decay heat of radioisotopes into useful electric power. Strontium-90 and lead telluride have been chosen for the power sources and thermoelectric materials. Two studies are reported; one covers a 100-w design for land or sea application and the other a parametric study of space power applications for optimization of conditions. To provide 2000 watts of thermal power, 15 kg of Sr^{90} will be employed as a strontium titanate-chromium cermet. The present design consists of seven strontium titanate cylinders with cladding placed in a circular arrangement in a cylindrical block, which serves as the heat source. (W.D.M.)

17443

RADIOTRACER TECHNIQUES USEFUL IN STUDYING LEVELING AS AN ELECTRODE POSITION PHENOMENON. Bernard J. Riley and Seward E. Beacom (General Motors Corp., Detroit). Nuclear Sci. and Eng. 2, No. 1, Suppl., 152-3(1959) June.

Sodium sulfite tagged with S^{35} was utilized in the synthesis of an organic addition agent, sodium allyl sulfonate, which is known to promote leveling in a bright nickel plating bath. Using a serrated brass cathode in such a bath it was possible to produce thin plates which could be removed from the cathode as serrated foils. Two techniques are described which were used to locate the leveling agent or its reduction product containing the S^{35} within the deposits. (W.D.M.)

17444

A NEW RADIATION THICKNESS GAGE AND METALS ANALYZER. Burton J. Moyer, Martin C. Reder, and Gustave A. Linenberger (Aerojet-General Nucleonics, San Ramon, Calif.). Nuclear Sci. and Eng. 2, No. 1, Suppl., 153-4(1959) June.

A radiation thickness gage and metals analyzer was developed which operates on the principle that, subsequent to beta particle excitation, a material under examination returns to the ground state by the emission of

x-rays characteristic of the various elements in the material. K-shell emission is the usual mode of this return to the ground state. A schematic diagram of the device is given. Calculations indicate the new gage is sufficiently sensitive to detect a 1×10^{-6}-in. variation in a 15×10^{-6}-in. coating of tin on iron by providing an 8% change in counting ratio. (W.D.M.)

17445

THE HEAVY WATER COMPONENTS TEST REACTOR. L. M. Arnett (E. I. du Pont de Nemours and Co., Aiken, S. C.). Nuclear Sci. and Eng. 2, No. 1, Suppl., 155-6 (1959) June.

The Heavy Water Components Test Reactor (HWCTR) is to be built at the Savannah River Plant to test full-size fuel elements that are candidates for use in reactors. The HWCTR will have the capability of testing up to twelve assemblies, each 10 ft long, at temperatures and powers equal to those expected in economical power reactors. The HWCTR will be cooled and moderated with pressurized D_2O. The maximum operating conditions will be a pressure of 1500 psi, a D_2O temperature of 290°C, and a power of about 70 Mw. A lattice diagram is shown and the pressure vessel and containment building is described. (W.D.M.)

17446

NEUTRON ECONOMY IN A CRITICAL MOCKUP OF THE HEAVY WATER COMPONENTS TEST REACTOR. N. P. Bauman, W. E. Graves, and G. F. O'Neill (E. I. du Pont de Nemours and Co., Aiken, S. C.). Nuclear Sci. and Eng. 2, No. 1, Suppl., 156(1959) June.

To investigate variable leakage and complex interactions of systems, a full-scale nuclear mockup of the HWCTR was constructed in the reactor tank of the Process Development Pile. In the initial experiments performed in the mockup a study was made of the proper strength for the boron poison in the driver assemblies and in the control rods to obtain the desired operating characteristics of the HWCTR. A variety of methods was used to obtain differential and integral worths of the control rods. A series of flux traverses and neutron current determinations at the pile boundaries was undertaken to determine the over-all neutron economy under various reactor conditions. (W.D.M.)

17447

FLUX DISTRIBUTIONS IN A CRITICAL MOCKUP OF THE HEAVY WATER COMPONENTS TEST REACTOR. W. E. Graves and T. J. Hurley (E. I. du Pont de Nemours and Co., Aiken, S. C.). Nuclear Sci. and Eng. 2, No. 1, Suppl., 157(1959) June.

Large-scale changes in the neutron flux distribution are possible in the HWCTR, corresponding to the large reactivity transients which will be experienced. To investigate the magnitude of the actual effects, the vertical, azimuthal, and radial flux shapes were determined for a wide range of possible control rod configurations in the reactor mockup. Flux shapes around the tubular fuel assemblies were also investigated. (W.D.M.)

17448

CALCULATIONS OF PHYSICS PARAMETERS OF THE HEAVY WATER COMPONENTS TEST REACTOR. J. W. Wade (E. I. du Pont de Nemours and Co., Aiken, S. C.). Nuclear Sci. and Eng. 2, No. 1, Suppl., 157-8 (1959) June.

Calculations to determine the physics parameters of the HWCTR gave guidance for the initial design, later experiments, and safeguards evaluation. For calculation purposes, the lattice was divided into four concentric regions—the test region, the control region, the driver region, and the reflector. Two-group diffusion equations were then solved in these regions to obtain the radial neutron flux distribution. Items calculated include reactivity transients, heat generation in the fuel assemblies, moderator temperature coefficient, and effects of void formation and H_2O contamination on reactivity. (W.D.M.)

17449

POWER EXCURSIONS IN THE HEAVY WATER COMPONENTS TEST REACTOR. D. Randall and D. S. St. John (E. I. du Pont de Nemours and Co., Aiken, S. C.). Nuclear Sci. and Eng. 2, No. 1, 158(1959) June.

Power, temperature, and pressure transients in the HWCTR were calculated for loss of coolant flow, heat exchanger bypass valve opening, ramp additions, and short-period flux increases. (W.D.M.)

17450

CONSTRUCTION OF THE ARGONNE LOW POWER REACTOR. C. R. Braun and E. E. Hamer (Argonne National Lab., Lemont, Ill.). Nuclear Sci. and Eng. 2, No. 1, Suppl., 159-60(1959) June.

The Argonne Low Power Reactor (ALPR or SL-1) was designed and constructed as a protytype of a remote auxiliary DEW Line radar station power plant. The ALPR is a 3 Mwh, enriched-uranium-fueled, direct-cycle, natural circulation boiling water reactor, cooled and moderated with light water. It is designed to produce electric power (200 kw net plus 60 kw overload plus plant load) and space heat (400 kw net). The construction is reviewed, and a cost breakdown is given. A schematic drawing of the reactor and a plan of the reactor site are shown. (W.D.M.)

17451

EARLY OPERATING EXPERIENCES WITH THE ARGONNE LOW POWER REACTOR. R. W. Thiel, A. P. Gavin, A. Smaardyk, W. R. Wallin, J. D. Cerchione, and M. Novick (Argonne National Lab., Lemont, Ill.). Nuclear Sci. and Eng. 2, No. 1, Suppl., 160-1(1959) June.

The ALPR designed by ANL and located at NRTS is described. Prior to core loading, the process systems were operated and checked out by means of a portable steam generator. Nuclear characteristics were determined "in place." Actual characteristics proved to be in good agreement with calculations. A number of changes and improvements were completed in both the electrical and mechanical portions of the plant. A reactor water decomposition rate of 16 cc O_2/l of condensed water was measured and appears to be constant for varying power levels. (W.D.M.)

17452

A BOILING D_2O-COOLED, PRESSURE TUBE, POWER REACTOR. Joseph A. DeFelice and William A. Loeb (Nuclear Development Corp. of America, White Plains, N. Y.). Nuclear Sci. and Eng. 2, No. 1, Suppl., 161-2 (1959) June.

A study of D_2O-moderated power reactors was made by Sargent and Lundy and NDA. The study had two objectives: (1) a comparative evaluation of all D_2O natural uranium power reactors and recommendation of a conceptual design of one of them; (2) a detailed design of a prototype of the selected design. The full-scale plant recommended as a result of the study utilizes a direct cycle, boiling D_2O reactor-turbine system to produce

206 Mwe. Heavy steam is produced in the tubes of a pressure tube type reactor. The coolant temperatures are 498°F at input and 515°F at output. The fuel elements are 0.5-in.-diam. UO_2 rods clad with Zircaloy and arranged in 37 rod clusters. (W.D.M.)

17453

CRITICAL DIMENSIONS OF UNREFLECTED BeO SYSTEMS FUELED BY THIN ENRICHED URANIUM FOILS. F. A. Kloverstrom, R. M. Deck, and A. J. Reyenga (University of California, Livermore). Nuclear Sci. and Eng. 2, No. 1, Suppl., 162-3(1959) June.

A series of critical measurements on unreflected parallelepipeds built of enriched (93.2%) uranium foils and BeO blocks was made for five fuel densities. The over-all fuel density was variable by changing the foil thickness and/or spacing. The assembly consists of a horizontal steel diaphragm suspended above a vertically moving table. The major portion of an assembly is built on the table and the remainder on the diaphragm. The two parts are assembled remotely by lifting the table. The thermal neutron absorption cross section for BeO was found to be 12 ± 2 mb. Results obtained to date are summarized. (W.D.M.)

17454

REACTIVITY EFFECTS OF LARGE VOIDS IN THE REFLECTOR OF A LIGHT-WATER-MODERATED AND REFLECTED REACTOR. A. B. Reynolds, K. M. Henry, and E. B. Johnson (Oak Ridge National Lab., Tenn.) and T. J. Thompson (Massachusetts Inst. of Tech., Cambridge). Nuclear Sci. and Eng. 2, No. 1, Suppl., 163-5(1959) June.

Reactivity effects of large voids in the reflector of the Pool Critical Assembly (PCA), an enriched-uranium, light-water-moderated and -reflected, pool-type reactor, were investigated experimentally and theoretically. The four principal effects measured were the variations of reactivity of voids at the center of a core face, void position on core face, and separation distance between void and core face. Superposability of the reactivity effects of multiple voids was studied. The effect of the largest void on the thermal neutron flux distribution was measured. (W.D.M.)

17455

A MEASUREMENT OF THERMAL UTILIZATION IN A NON-UNIFORM UO_2–H_2O LATTICE. R. E. Hill (General Electric Co., San Jose, Calif.). Nuclear Sci. and Eng. 2, No. 1, Suppl., 165-6(1959) June.

In a nonuniform lattice the problem of measuring the thermal utilization is complicated by the increased size of the equivalent cell. Measurement of the thermal utilization in the Dresden Critical Assembly lattice is described. An integral technique designed to facilitate the measurement of the average flux in the moderator over a large cell was used. One of the central equivalent control rod cells was enclosed by a Plexiglas tank which isolated it from the rest of the system. The tank was filled with an aqueous solution of $MnSO_4$. After irradiation the average activation of Mn in the water and fuel was measured. (W.D.M.)

17456

FLUX TO FISSION RATES IN ANNULAR CORES. K. E. Plumlee and S. G. Kaufmann (Argonne National Lab., Lemont, Ill.). Nuclear Sci. and Eng. 2, No. 1, Suppl., 166-7(1959) June.

The effects of thermal flux peaking in moderator regions near the fuel may be used to build research reactors in which a maximum thermal flux may be produced with minimum reactor power. A succession of cores of annular shape enclosing a central cylindrical thermal column was investigated in order to chart the changes of the ratio of peak thermal flux to power over a limited range of core geometries and fuel to moderator ratios. The assemblies are described. Flux traverses in the radial and vertical directions, absolute measurements of fission rates and thermal peak fluxes, cadmium ratios, and reactivity effects of Cd, U, and void samples in both thermal column and core region were determined in a number of configurations. (W.D.M.)

17457

CLUSTERING EXPERIMENTS WITH ThO_2–UO_2 FUEL IN D_2O. W. C. Redman and J. A. Beidelman (Argonne National Lab., Lemont, Ill.). Nuclear Sci. and Eng. 2, No. 1, Suppl., 167-8(1959) June.

The fuel, contained in $^5/_{16}$-in. OD aluminum tubes, has a diameter of 0.23 in., a density of 8.4 gm/cm^3, and a Th to U^{235} atom ratio of 25. The first phase of the clustering experiments related the cluster spacing, rods per cluster, and buckling, to the bucklings for uniform systems. The critical water heights were observed for thirty configurations achieved by uniform stepwise removal of fuel pins from the periphery of the clusters. The effect of clustering was also investigated in a core arrangement suitable for the proposed D_2O operation of EBWR. (W.D.M.)

17458

REACTIVITY AND FLUX MEASUREMENTS IN HIGHLY REFLECTED U^{235}-BISMUTH-GRAPHITE CRITICAL EXPERIMENTS. T. C. Engelder, H. W. Giesler, and J. P. Farrarr (Babcock and Wilcox Co.). Nuclear Sci. and Eng. 2, No. 1, Suppl., 168-9(1959) June.

The Liquid Metal Fuel Reactor Experiment research and development program includes a series of critical experiments on U^{235}–Bi–graphite cores, highly reflected by graphite. The critical assembly is described and parameters are given. In the first set of experiments, the uranium concentration was varied, keeping the side and end reflector 2 to 3 ft thick. The critical diameters for the concentrations are reported. Flux traverses, intra-cell thermal flux structure, and reflector and geometrical effects were measured. (W.D.M.)

17459

CONTROL BLADE WORTH BY PARTIAL WATER HEIGHT AND SOLUBLE BORON METHODS. A. L. MacKinney and R. M. Ball (Babcock and Wilcox Co.). Nuclear Sci. and Eng. 2, No. 1, Suppl., 169-70(1959) June.

Evaluations of fully inserted patterns of cruciform control blades were made in slightly enriched, ordinary-water moderated cores. A curve of differential reactivity with water height was measured. This curve is integrated to develop a plot of reactivity as a function of water height. Soluble boron experiments were performed by inserting a small amount of boric acid into the water moderator-reflector, and by measuring its associated reactivity change. Some of the parameters of the UO_2 (stainless steel clad) core are given and some typical results are summarized. (W.D.M.)

17460

WATER WORTH METHODS IN DETERMINING M^2 IN

THUD CORES. A. B. Rothman and E. M. Pennington (Argonne National Lab., Lemont, Ill.). Nuclear Sci. and Eng. 2, No. 1, Suppl., 170-1(1959) June.

The method of determining M^2 from the differential water worth derived by rising period measurements was based on the relationship $(\Delta\rho/\Delta h) = (2\pi^2M^2/H_3)$ $(1 + c)$, were $\Delta\rho$ is the change in reactivity associated with a change in core height (h), H is the extrapolated core height, M^2 is the modified migration area, and C expresses changes in reflector savings produced by the departure from criticality with increase in core height. Values of C were evaluated by four methods for several THUD cores with a $\frac{3}{4}$-in. lattice spacing. Exploratory tests are described which were conducted on a new water worth method to determine M^2. (W.D.M.)

17461

AN AUTOMATIC WELDING MACHINE FOR SOURCE ENCAPSULATION. Charles E. Saunders (American Machine and Foundry Co.). Nuclear Sci. and Eng. 2, No. 1, Suppl., 172(1959) June.

The equipment consists of a remotely operated welding carriage, an automatic welding head, an ac-dc welder, and several remotely operated pneumatic cylinders for performing various preliminary operations. The carriage, welding head, and cylinders are mounted on a console-type stand which is driven into the cell on a cart. The welder, automatic head-control box, gas cylinder, and water source are located outside the cell. Operation of the welding machine is described. (W.D.M.)

17462

HEAT TRANSFER IN IRRADIATION CAPSULES. J. H. Stang and W. H. Goldthwaite (Battelle Memorial Inst., Columbus, Ohio). Nuclear Sci. and Eng. 2, No. 1, Suppl., 172-3(1959) June.

Heat transfer problems encountered in capsule design and practical situations that have been dealt with successfully are considered. Included are discussions of capsule designs based on single and double wall construction for insertion in tank- or pool-type reactors where the capsule size is limited to $2\frac{1}{2}$-in. OD or less. A review is given of methods of creating appropriate radial heat flow paths within capsules of limited size by the use of metallic fins, high conductivity liquid metals, and gases having different conductivities. Attention is paid to the value of monitoring intracapsule temperatures by thermocouples. (W.D.M.)

17463

CIRCULATING FUSED-SALT-FUEL IRRADIATION TEST LOOP. D. B. Trauger and J. A. Conlin (Oak Ridge National Lab., Tenn.). Nuclear Sci. and Eng. 2, No. 1, Suppl., 173-4(1959) June.

Several in-pile loop experiments were conducted for the fused salt reactor system using the HB-3 irradiation facility of the MTR. The corrosion data obtained indicated, for the salt-container combinations used, that the corrosion rate is low and that there is no observable increase in corrosion which can be attributed to radiation damage. The engineering aspects of the in-pile loops and their operating characteristics are discussed. (W.D.M.)

17464

DESIGN AND OPERATION OF FORCED-CIRCULATION CORROSION LOOPS WITH MOLTEN SALTS. W. B. McDonald, J. L. Crowley, and D. L. Clark (Oak Ridge National Lab., Tenn.). Nuclear Sci. and Eng. 2, No. 1, Suppl., 174-6(1959) June.

In order to simulate reactor conditions, except radiation, a molten-fluoride-salt forced circulation corrosion testing loop and the auxiliary equipment for operating it were developed which will perform reliably for a year or longer. The loop and test stand were standardized for ready replacement and repair, and protective features are included that are adequate to guard against premature failure. The loop includes two heated sections, a cooled section, and a centrifugal sump-type pump. The loop is constructed of $\frac{1}{2}$-in. diam. 0.045-in.-wall tubing fabricated of the material to be tested. (W.D.M.)

17465

A SODIUM GRAPHITE REACTOR IRRADIATION FACILITY. Don S. Thompson (Atomics International Div., North American Aviation, Inc., Canoga Park, Calif.). Nuclear Sci. and Eng. 2, No. 1, Suppl., 176-7(1959) June.

A preliminary design study to incorporate a food irradiation facility into an operating sodium graphite reactor was conducted. Reference design criteria were based on operating characteristics associated with the Hallam Power Reactor, a 254 Mwh SGR. Liquid sodium, circulating through rectangular irradiation plaques in the facility at approximately 100 gpm, is taken from the cold legs of the HPR intermediate heat exchangers. The facility capacity is estimated between 523 and 800 ton/day to a total integrated dose of 1×10^5 rep. The facility is expected to cost about $770,000. (W.D.M.)

17466

FISSION GAS GAMMA FACILITY. W. N. McElroy and C. W. Terrell (Armour Research Foundation, Chicago). Nuclear Sci. and Eng. 2, No. 1, Suppl., 178-9(1959) June.

Since 1958 the Armour Research Reactor power has been raised substantially permitting a significant extension of the earlier data. For a set of standard reactor operating conditions, a factor of four increase in reactor power resulted in a factor of eight increase in the dose rate in the exposure port. Additional parameters determined experimentally included the effects of fuel temperature on dose rate, the build-up and decay of the gas phase activity, and a typical dose rate profile in a port. (W.D.M.)

17467

AN ISODOSE Cs^{137} IRRADIATOR. Louis Scheib and Paul Thurlow (American Machine and Foundry Co.). Nuclear Sci. and Eng. 2, No. 1, Suppl., 179-81(1959) June.

The Cs^{137} Isodose Irradiator provides a uniform gamma dose rate over an irradiation volume 5 cm high with a 20 cm^2 cross section from two sources located above and below the station on the vertical centerline. Between each source and this station is a contour shield. The irradiator consists basically of three major components, the feed table, the irradiation chamber, and the support stand. Various views of the unit are shown. The actual arrangement is such that the dose rate variation is less than 2.5% of the mean value, which is 12,500 r/hr with the Cs^{137} source. (W.D.M.)

17468

A STATE-OF-THE-ART FILE ON RADIATION EF-

FECTS TO ELECTRONIC COMPONENTS AND MATERIALS. James R. Burnett. Nuclear Sci. and Eng. 2, No. 1, Suppl., 181(1959) June.

The purpose of the Radiation Effects File is to supply designers with available information on the effects of radiation on electronic components and materials. Effects data are color coded on cards to indicate the degree of radiation resistance of the item. Information is available on about 900 specific electronic components. (W.D.M.)

17469

CALCULATION OF REACTIVITY DURING POWER TRANSIENTS. A. L. Morse (Ramo-Wooldridge Corp., Los Angeles). Nuclear Sci. and Eng. 2, No. 1, Suppl., 182-3(1959) June.

An approximate solution of the reactor kinetic equations is given that is especially adapted to the accurate calculation of the reactivity during a fast transient or a series of power pulses. The method exploits the fact that the rate at which precursors are generated is almost proportional to the power, so that, if the duration of the power pulse is small compared to the precursor decay time, the total increase in the precursor density during a pulse is proportional to the energy released. (W.D.M.)

17470

REACTOR POWER TRANSIENTS AS CALCULATED BY THE NON-LINEAR SPACE INDEPENDENT REACTOR EQUATIONS. K. V. Moore and W. J. Byron (Phillips Petroleum Co., Idaho Falls, Idaho). Nuclear Sci. and Eng. 2, No. 1, Suppl., 183-4(1959) June.

The MTR-ETR Safeguards Committee must approve the insertion of all experiments into, and any alteration of the mode of operation of, these test reactors. Both require an examination to determine the degree of jeopardy, if any, to safe reactor operation. Some of the problems arising and the methods and philosophy used at the MTR-ETR in dealing with such examinations are briefly described. The transient calculations were performed on an IBM-650 computer by numerically integrating the non-linear space independent reactor equations. Startup accidents of the MTR fueled with U^{235}, Pu^{239}, and U^{233} are illustrated. (W.D.M.)

17471

REACTIVITY CHANGES ASSOCIATED WITH A SPECIFIED POWER RESPONSE. Paul R. Kasten and Seymour Jaye (Oak Ridge National Lab., Tenn.). Nuclear Sci. and Eng. 2, No. 1, Suppl., 184-5(1959) June.

The analysis of reactor behavior usually considers power response to specific reactivity changes; however during operation of a reactor, it is the power-time relation which is recorded, and not the reactivity changes. Starting with the conventional space-independent reactor kinetic equations, and an energy balance on the system, the reactivity which has been added to the system was related to the reactor power and its derivative, and to the integrated power. If the total time is broken up into small time intervals, such that x(t) (the ratio of power at time t to that at time zero) is linear with time in any one interval, then the integral terms can be written as finite sums. The resulting analytical expressions were coded for the IBM-704. The program was used in obtaining a reactivity-time behavior from the power-time relations observed during operation of the Homogeneous Reactor Test. (W.D.M.)

17472

EFFECTS OF DOPPLER COEFFICIENT UPON PLANT KINETICS. J. M. Gallagher, Jr. (Westinghouse Electric Corp., Pittsburgh). Nuclear Sci. and Eng. 2, No. 1, Suppl., 185-7(1959) June.

Distortion of resonance peaks by variations in oxide fuel temperature gives rise to a reactivity feedback termed the Doppler coefficient in pressurized water reactors. Effects of the Doppler coefficient on expansion or contraction of primary coolant volume, increase in variation in secondary steam pressure as a function of load level, and stability are discussed. A partial self-compensating feature of the Doppler coefficient is the reduction in effective load change impressed upon the primary system when the rise in steam generator pressure is constrained. A major advantage of the Doppler coefficient is the reduction in power excursions associated with rapid insertions of reactivity directly into the core. (W.D.M.)

17473

STATIC AND DYNAMIC MULTIPLICATION FACTORS AND THEIR RELATION TO THE INHOUR EQUATION. E. E. Gross and J. H. Marable (Oak Ridge National Lab., Tenn.). Nuclear Sci. and Eng. 2, No. 1, Suppl., 187-8(1959) June.

In the usual derivation of the inhour equation no distinction is made between the "dynamic" multiplication factor and the "static" multiplication factor that arise from conventional static reactor theory. Specific definitions for the static and dynamic multiplication factors are presented that allow investigation of their properties. It is shown that the relation between them is closely connected to the effective delayed neutron fractions appearing in certain formulations of the inhour equation. (W.D.M.)

17474

NUMERICAL COMPUTATIONS FOR FISSION BURSTS IN PULSED REACTORS. D. L. Hetrick, M. S. Dunenfeld, and A. Schwartz (Atomics International Div., North American Aviation, Inc., Canoga Park, Calif.). Nuclear Sci. and Eng. 2, No. 1, Suppl., 188-9(1959) June.

The reactor kinetics program (AIREK) for the IBM-704 was applied to calculations of fast power excursions in several typical pulsed reactors. A brief discussion of some of the unique features of the code, a summary of results obtained for four different pulsed reactors, and a quantitative study of the sensitivity of the computed peak power to variations in the system parameters are presented. (W.D.M.)

17475

THE TIME-DEPENDENT IMPORTANCE FOR NEUTRONS AND PRECURSORS. Jeffery Lewins (Massachusetts Inst. of Tech., Cambridge). Nuclear Sci. and Eng. 2, No. 1, Suppl., 189-90(1959) June.

The equations for the importance are derived in the diffusion approximation with the same approximation as for simple diffusion theory. For consistency, the total importance of the progeny of one neutron in subsequent generations is conserved. The transport of importance is due partly to diffusion and partly to transfer between groups. Diffusion is governed by the divergence of the previously derived importance current. Transferred neutrons tend to increase the importance of the remaining neutrons but, unlike absorbed neutrons, leave the group with still some probability of further progeny. (W.D.M.)

17476

THEORY OF TIME-DEPENDENT THERMAL SPECTRA IN FINITE MULTIPLYING MEDIA. T. J. Krieger (Knolls Atomic Power Lab., Schenectady, N. Y.). Nuclear Sci. and Eng. 2, No. 1, Suppl., 191(1959) June.

Recently an equation for the asymptotic decay rate of a thermalized pulse of fast neutrons in a finite homogeneous multiplying medium was derived on the basis of time-dependent "asymptotic" reactor theory. A more general method is presented which includes thermal spectrum and delayed neutron effects. The method is based on energy-dependent diffusion theory and the assumption of an energy-dependent extrapolation distance. (W.D.M.)

17477

BOUNDEDNESS AND STABILITY IN NON-LINEAR NUCLEAR REACTOR DYNAMICS. Elias P. Gyftopoulos and Jacques Devooght (Massachusetts Inst. of Tech., Cambridge). Nuclear Sci. and Eng. 2, No. 1, Suppl., 192-3(1959) June.

The dynamics of nuclear power reactors can be described by non-linear integro-differential equations. The problem of boundedness and stability of the solutions of these equations has been presented by Welton. A novel formulation of the same problem is presented. (W.D.M.)

17478

FUNDAMENTAL MODE NEUTRON DISTRIBUTION IN PULSED COMPOSITE SYSTEMS. Edward C. Campbell (Oak Ridge National Lab., Tenn.). Nuclear Sci. and Eng. 2, No. 1, Suppl. 193-4(1959) June.

The simple asymptotic solution of the time-dependent neutron diffusion problem in a finite convex homogeneous non-multiplying medium excited by a pulsed neutron source defines a fundamental mode neutron density distribution which is characterized by a geometrical buckling and a decay rate. The fundamental mode is investigated for a system made up of two or more contiguous regions containing material with different absorption cross sections and diffusion constants. (W.D.M.)

17479

EVALUATION OF SILICON DIODE IRRADIATION RESULTS IN TERMS OF MAGNETIC AMPLIFIER PERFORMANCE. Jack A. Russell (General Electric Co., Cincinnati). Nuclear Sci. and Eng. 2, No. 1, Suppl., 194-6(1959) June.

Three generic types of silicon diode behavior under irradiation were simulated by the addition of other electrical devices to actual diodes, producing a set of curves which are characteristic of a diffused junction diode, an alloy junction, and a mixture of the two. The simulation was then applied to full-wave and half-wave magnetic amplifiers, and the performance of the amplifiers was evaluated. (W.D.M.)

17480

RADIATION AND TEMPERATURE TESTS OF MINIATURE TRANSISTOR AMPLIFIERS. James E. Mott (General Electric Co., Cincinnati). Nuclear Sci. and Eng. 2, No. 1, Suppl., 196-8(1959) June.

In the application of transistorized reactor control circuitry to airborne nuclear systems, two factors of particular interest are the effects of radiation and high temperatures. The results of radiation and temperature tests run on two different types of miniature transistor feedback amplifiers are presented. One of the amplifier types was successfully tested to a temperature of 150°C, a gamma irradiation of 4.7×10^7r, and a fast neutron dosage of 7.0×10^{13} nvt. (W.D.M.)

17481

BEHAVIOR OF SOLID TANTALUM ELECTROLYTIC CAPACITORS DURING EXPOSURE TO NUCLEAR RADIATION. R. M. Magee. Nuclear Sci. and Eng. 2, No. 1, Suppl., 198-9(1959) June.

Tests were conducted at the Ford Nuclear Reactor to determine the radiation resistance of five types of solid tantalum electrolytic capacitors. All of the capacitors were of essentially standard construction, utilizing tantalum anodes, tantalum pentoxide dielectrics, and manganese dioxide electrolytes. Eighteen units of each type were tested. Parameters measured during the tests were capacitance, dissipation factor, and leakage resistance. The capacitors were irradiated to a total integrated fast neutron flux of about 4×10^{16} neutrons/cm^2. Data for the capacitors that were tested at rated voltages are summarized briefly. (W.D.M.)

17482

WIDE-RANGE NEUTRON DETECTOR. K. Porges and T. Klippert (Armour Research Foundation, Chicago). Nuclear Sci. and Eng. 2, No. 1, Suppl., 199(1959) June.

A boron-lined or BF_3-filled proportional counter was developed whose cathode diameter varies continuously, hence varying the gas multiplication along the length of the counter. The sensitive volume of the counter thus becomes a function of applied voltage, electrical amplification, and pulse-height discrimination. An interesting feature of the counter is the inverse variation of the applied voltage with the logarithm of the neutron flux if the counting rate is kept constant by feedback circuitry, thus yielding a direct logarithmic readout. (W.D.M.)

17483

DEVELOPMENT OF A HIGH-LEVEL ION CHAMBER. E. G. Bylander (Convair, Fort Worth, Tex.). Nuclear Sci. and Eng. 2, No. 1, Suppl., 200-1(1959) June.

Starting with a design by Abele, a mechanically simpler chamber which uses the same electrode configuration was developed and constructed. Its neutron sensitivity, upper limit of dose-rate measurement, linearity, and temperature characteristics were determined. The chamber is constructed of aluminum, graphite, and fluoroethane or Mykroy. An instrument was assembled which is capable of routine measurements having ± 5% linearity and ± 1% precision. It consists of a micromicroammeter, a recording potentiometer, and a gas flow system. (W.D.M.)

17484

A SIMPLIFIED LOGARITHMIC POWER LEVEL INDICATOR UTILIZING NOISE. Charles Erwin Cohn (Argonne National Lab., Lemont, Ill.). Nuclear Sci. and Eng. 2, No. 1, Suppl., 201-2(1959) June.

A logarithmic reactor power-level indicator was developed which avoids much of the complexity associated with present systems. The instrument uses a photomultiplier with a Hornyak-type neutron-sensitive scintillator for a detector. The circuit uses the random noise which accompanies the signal instead of the d-c output from the phototube. A block diagram of the circuit is shown. The absence of d-c amplifiers and specially selected components results in a simple, trouble-free, low cost unit. (W.D.M.)

17485

MAGNETIC FIELD MEASUREMENTS ON THE STRONG FOCUSSING QUADRUPOLE MAGNETS OF A LINEAR ACCELERATOR. W. J. Knox, A. R. Quinton, and M. S. Malkin (Yale Univ., New Haven). Nuclear Sci. and Eng. 2, No. 1, Suppl., 202(1959) June.

The Yale heavy-ion linear accelerator consists of a Cockcroft-Walton injector, a grid-focussed drift tube section, and a strong focussing drift tube section for acceleration of ions from 0.045 to 0.14c. The latter section contains 67 drift tubes each containing a quadrupole magnet for strong focussing of the beam. The position of the magnetic center of a quadrupole field and orientations of the quadrupole axes were determined with small coils. (W.D.M.)

17486

EXPERIMENTAL STUDY OF N^{16} CONCENTRATIONS IN WATER AND STEAM OF EBWR PRESSURE VESSEL. Michel H. Theys and Robert L. Mittl (Argonne National Lab., Lemont, Ill.). Nuclear Sci. and Eng. 2, No. 1, Suppl., 203-4(1959) June.

An experiment was conducted on the EBWR to measure the absolute concentrations of N^{16} nuclides in the water and steam of the reactor. Continuous samples of steam and water were taken at different elevations in the reactor vessel and were analyzed by a scintillation counter. The results of experiments performed at power levels between 10 and 30 Mwh showed that concentrations of N^{16} in the water were proportional to the power, and those in the steam were proportional to the square of the power. The mechanism of partition of N^{16} between the water and steam was studied. (W.D.M.)

17487

ACTIVITY IN REACTOR COOLANTS FROM RECOIL NUCLEI. J. E. Stewart (Atomics International Div., North American Aviation, Inc., Canoga Park, Calif.). Nuclear Sci. and Eng. 2, No. 1, Suppl., 204-5(1959) June.

Coolant radioactivity from recoil nuclei in water-cooled and organic-cooled reactors is discussed in detail. Several methods for calculating the activity are reviewed and applied to predicting the Na^{24} activity in MTR. Effects of oxides and carbon coatings on the coolant activity are considered. (W.D.M.)

17488

RELEASE OF FISSION PRODUCTS FROM MELTING FUEL ASSEMBLIES. J. W. Mausteller, S. J. Rodgers, and G. E. Kennedy (Mine Safety Appliance Research Corp.) and W. A. McAllister (Westinghouse Electric Corp., Pittsburgh). Nuclear Sci. and Eng. 2, No. 1, Suppl., 205-7(1959) June.

Induction melting of test assemblies was used to investigate the melting behavior, amount of metal–water reaction, and fission product release for Zircaloy-clad, U–Zr alloy fuel material. The experiments were performed in an atmosphere of flowing steam such as might be present after loss of primary coolant in PWR's. The experimental setup is described, and results for Xe, I, and other nuclides are summarized for various heating times. (W.D.M.)

17489

RELEASE OF FISSION PRODUCTS FROM DEFECTED ThO_2–UO_2 CERAMIC FUEL ELEMENTS IN A BOILING WATER REACTOR. R. F. S. Robertson and R. E. Bailey (Argonne National Lab., Lemont, Ill.). Nuclear Sci. and Eng. 2, No. 1, Suppl., 207-8(1959) June.

Two tests are described which were carried out in the EBWR to establish the rates of release of fission products from ThO_2–UO_2 (stainless steel clad) fuel and to assess the magnitude of the resulting operational problems. The fuel used in both tests was 90 wt.% ThO_2–10% U^{235} O_2 in the form of pellets. In test number one the clad element was 3.1 in. long and was subjected to 3% burnup. In test number two the element was 48 in. long and was subjected to a 7% burnup. Activities of various nuclides in the reactor water and the evolution of fission product gases were measured for each test. (W.D.M.)

17490

LOCATING DEFECTIVE FUEL ELEMENTS IN BORAX IV. G. K. Whitham (Argonne National Lab., Lemont, Ill.). Nuclear Sci. and Eng. 2, No. 1, Suppl., 208-9(1959) June.

During operation of Borax IV, Cs^{138} and Rb^{88} were identified on a building air filter. This definitely proved that fission product gases were being released from the system. Specific experiments at known powers were conducted to separate fission gas samples from the steam. From radiochemical procedures, it was possible to calculate the minimum amount of exposed U^{235}. After several unsuccessful attempts to locate the faulty elements, a simple autoclave technique was developed which promptly detected 22 fuel elements with defective cladding among the original 59. (W.D.M.)

17491

FISSION PRODUCT MONITORING TECHNIQUES IN GAS COOLED REACTORS. E. S. Collins, P. K. Conn, and J. B. Trice (General Electric Co., Cincinnati). Nuclear Sci. and Eng. 2, No. 1, Suppl., 209-10(1959) June.

Both detection and an accurate appraisal of the quantity of coolant gas activity is necessary in fission product monitoring in gas-cooled reactors. Two methods are described which were examined on a test system in the Low Intensity Test Reactor. In one of these methods, fission products were "cold trapped" on an adsorbent; in the other, activities were observed directly by radiation detection instruments. Cold trapping with activated charcoal, which providing the most accurate results, did not yield instantaneous observations, whereas the converse was true for the instrumental method. (W.D.M.)

17492

ISOTOPE DEPOSITION HAZARDS IN GAS CYCLE REACTORS. P. K. Conn, E. S. Collins, and J. B. Trice (General Electric Co., Cincinnati). Nuclear Sci. and Eng. 2, No. 1, Suppl., 210-11(1959) June.

In the evaluation of a test system in the Low Intensity Test Reactor at ORNL, data were obtained on the deposition of fission products throughout the system. The isotopes studied were I^{131}, Ba^{140}, Pu^{103}, Sr^{89}, and Te^{132}. The system consisted of an access bellows, approximately 18 ft long, extending into the core of the reactor. The isotope source was positioned in the core and was connected to air inlet and exit lines, extending into the core of the reactor. A summary of the data is presented. (W.D.M.)

17493

REACTOR DAMAGE EXPERIMENT. R. E. Baker, C. C. Gamertsfelder, and R. F. Gentzler (General Electric Co., Cincinnati). Nuclear Sci. and Eng. 2, No. 1, Suppl., 211-12(1959) June.

An experimental program was initiated to obtain a

better understanding of the nature and magnitude of reactor damage and the resulting radiological hazards resulting from loss of coolant flow to an air-cooled reactor operating at power. The experiment was performed at NRTS in the HTRE-2 central void. The HTRE-2 was carried in the core Test Facility which was coupled to the Initial Engine Test Facility. The IETF provided power, control instrumentation, and provision for routing the engine exhaust up a stack. One metallic element was fitted into the central void and allowed to overheat by closing the air flow valve. Temperatures and power levels were recorded during the test and downwind fall-out was measured. (W.D.M.)

17494

A SUMMARY OF EXPERIMENTAL RESULTS OF THE SPHERICAL CORE INVESTIGATIONS IN THE KEWB PROGRAM. R. K. Stitt (Atomics International Div., North American Aviation, Inc., Canoga Park, Calif.). Nuclear Sci. and Eng. 2, No. 1, Suppl., 212-13(1959) June.

The KEWB program examines the dynamic behavior of homogeneous research reactors. Investigations were made of the effect, on peak power, maximum pressure, and energy release, of the operating parameters; amount of reactivity released; initial core pressure; void volume above the fuel solution; rate of reactivity release; initial power level; and initial fuel temperature. Results are briefly summarized. (W.D.M.)

17495

A PROPOSED MODEL OF BUBBLE GROWTH DURING FAST TRANSIENTS IN THE KEWB REACTOR. D. P. Gamble (Atomics International Div., North American Aviation, Inc., Canoga Park, Calif.). Nuclear Sci. and Eng. 2, No. 1, Suppl., 213-14(1959) June.

Experimental evidence indicates that the dominant shutdown mechanism operating in the KEWB Reactor during short-period transients is void production from radiolytic gas evolution. Growth of bubbles required to produce the observed reactivity changes appears inexplainable on the basis of thermodynamics. Since the dissipation of large amounts of energy occurs in a small volume, a mechanism is proposed for the bubble formation which involves fission fragments. Excellent qualitative correlation is observed between predictions based on the model and experimental observations. (W.D.M.)

17496

THE MECHANISM OF MODERATOR EXPULSION IN SPERT I SHUTDOWN. S. G. Forbes and Park French (Phillips Petroleum Co., Idaho Falls, Idaho). Nuclear Sci. and Eng. 2, No. 1, Suppl., 214-15(1959) June.

A series of capsule-type experiments was performed in SPERT I to obtain more detailed information on moderator expulsion due to the processes of radiolytic gas and steam formation. Closed capsules containing fuel with moderator, or moderator alone, were placed in a high-flux region of the reactor. Provision was made for measuring pressure at constant volume, volume at constant pressure, and fuel temperature. From the experiments, it was concluded that radiolytic gas is not a primary contribution to the self-shutdown process in the SPERT I Reactor. (W.D.M.)

17497

MEASUREMENT OF SRE AND KEWB PROMPT-NEUTRON LIFETIME USING RANDOM-NOISE AND PILE-OSCILLATION TECHNIQUES. C. W. Griffin and J. G. Lundholm, Jr. (Atomics International Div., North American Aviation, Inc., Canoga Park, Calif.). Nuclear Sci. and Eng. 2, No. 1, Suppl., 215-16(1959) June.

The prompt neutron lifetimes in KEWB and SRE were determined using random reactor noise. That in SRE was also determined by the pile-oscillation technique. In both methods, use is made of the fact that $1/\beta$ is uniquely determined by the measured break frequency of the modulus of the reactor-transfer function. The oscillation technique was found to be more reliable for lifetime determinations in long lifetime where the break frequency is less than 5 cps. Reactor noise analysis is more dependable for thermal reactors which give lifetimes with break frequencies above 20 cps. (W.D.M.)

17498

EXPERIMENTAL MEASUREMENT OF SODIUM REACTOR EXPERIMENT POWER COEFFICIENT. J. G. Lundholm, Jr. and C. W. Griffin (Atomics International Div., North American Aviation, Inc., Canoga Park, Calif.). Nuclear Sci. and Eng. 2, No. 1, Suppl., 216-18(1959) June.

In order to study the dynamic stability of the SRE, the power coefficient of reactivity was measured utilizing oscillator techniques. By measuring the transfer function of the reactor at zero power and again at various powers, flow rates, and core ΔT, it was possible to determine the power coefficient for the various core-operating conditions. It is concluded that the SRE will always have excellent dynamic overall frequency ranges and operating conditions of practical importance. (W.D.M.)

17499

SIMULATION OF ENERGY RELEASE IN A RUNAWAY REACTOR. G. B. Huber and N. R. Zabel (Stanford Research Inst., Menlo Park, Calif.). Nuclear Sci. and Eng. 2, No. 1, Suppl., 218-19(1959) June.

The large amounts of heat generated during a reactor runaway can be expected to induce appreciable mechanical stresses in reactor components. An experimental study of damage from simulated reactor excursions was initiated in which the energy release is modeled as nearly as possible after that in an actual event. Simulation on a $\frac{1}{20}$th scale of most of the features of the runaway reactor power bursts can be accomplished with chemical energy sources, such as explosives. An energy release device is described which was developed to simulate the fastest reactor power excursions. Cylindrical scale models used for testing the excursions are constructed of concrete and steel. (W.D.M.)

17500

MEASUREMENT OF AIR-BLAST EFFECTS FROM SIMULATED NUCLEAR-REACTOR-CORE EXCURSIONS. W. C. Olson, R. J. Larson, and H. Goldstein (Ballistics Research Labs., Aberdeen Proving Ground, Md.). Nuclear Sci. and Eng. 2, No. 1, Suppl., 219-20 (1959) June.

Results are discussed from a method of determining the transient blast loading on a containment shell during a simulated reactor core excursion. Three methods of energy release were studied: suddenly releasing nitrogen gas at high static pressure; igniting a confined propellant; and detonating an explosive in an air- or water-filled simulated reactor core vessel. (W.D.M.)

17501

THE ELASTIC RESPONSE TO INTERNAL BLAST

LOADING OF MODELS OF OUTER CONTAINMENT STRUCTURES FOR NUCLEAR REACTORS. J. W. Hanna, W. O. Ewing, Jr., and W. E. Baker (Ballistics Research Labs., Aberdeen Proving Ground, Md.). Nuclear Sci. and Eng. 2, No. 1, Suppl., 220-2(1959) June.

A series of scale model outer containment shells was subjected to a number of model accidents. The accidents were simulated with properly scaled explosive charges detonated within the model structures and strain-time histories recorded with externally mounted strain gages. Results are presented for the elastic response part of the test. Four geometrically scaled models of nuclear reactor outer containment shells were tested. (W.D.M.)

17502

CORE AND CONTROL ROD STUDIES FOR THE MARTIN POWER REACTOR. Ralph A. Hoffmeister, William P. Kutz, and Edward A. Scicchitano (Martin Co., Baltimore). Nuclear Sci. and Eng. 2, No. 1, Suppl., 223-4(1959) June.

The analytical methods used in evaluating some of the nuclear characteristics of a small, water-moderated, highly enriched UO_2 reactor are outlined. Results of the theoretical studies are compared with experimental data obtained on the Martin Power Reactor Zero-power Test Core. The core studied was cylindrical, 23 in. high, 22 in. in diameter, and contained 1680 tubular fuel elements placed on a 0.485-in. triangular pitch. The core fuel and burnable-poison loadings for 1680 fuel elements were 20.1 kg of U^{235} and 150.7 g of natural boron. The core was controlled by seven Y-rods. The theoretical flux and power-density distributions in the core were calculated using a two-group, multiregion, one-dimensional code. The radial thermal flux in a two-element cell was calculated using the spherical harmonic approximation to the Boltzmann equation. (W.D.M.)

17503

GROUP ABSORPTION CROSS SECTIONS FOR LUMPED RESONANCE ABSORBERS. R. H. Sevy (Atomics International Div., North American Aviation, Inc., Canoga Park, Calif.). Nuclear Sci. and Eng. 2, No. 1, Suppl., 224-5(1959) June.

It is frequently desirable to include regions of resonance absorbing materials in spatial, few-group reactor calculations. Typical examples are natural uranium fuel and hafnium, silver, or indium control elements. A method for evaluating the group cross sections needed for such calculations is described. The physical problem treated is that of an absorbing slab in an infinite, hydrogen environment. The method is applied to the case of natural hafnium slabs, and the accuracy of several simplifying approximations is determined. (W.D.M.)

17504

APPLICATIONS OF PERTURBATION METHODS IN NUCLEAR-REACTOR ANALYSIS. E. Lantz (Knolls Atomic Power Lab., Schenectady, N. Y.). Nuclear Sci. and Eng. 2, No. 1, Suppl., 225-7(1959) June.

Perturbation methods can be applied readily to the calculation of: spatial reactivity coefficients of temperature, density, and material; region-wise control-rod perturbations; and prompt neutron lifetimes. The equations for multigroup diffusion perturbations are developed from basic first-order perturbation theory as outlined by Wigner. The adjoints for these equations can be obtained from a standard multigroup diffusion code by the group-reversal method. (W.D.M.)

17505

THE PARTICLE-SIZE SELF-SHIELDING OF BORON CARBIDE. D. A. Gavin and D. J. Anthony (Knolls Atomic Power Lab., Schenectady, N. Y.). Nuclear Sci. and Eng. 2, No. 1, Suppl., 227-8(1959) June.

The particle-size effect in the determination of the total self-shielding of boron carbide was evaluated in the range of particle size from 1 to 125 μ, in both a thermal neutron spectrum and in a hardened neutron spectrum. A series of reactivity coefficient measurements was made with boron carbide–aluminum disks containing 0.12, 0.36, 0.72, and 2.0 wt. % boron. The extrapolated reactivity coefficient at zero mass and particle size was used to determine the unshielded reactivity value of the boron carbide. By dividing the thin B_4C reactivity coefficients by the unshielded value, the self-shielding due to the particle size was obtained. (W.D.M.)

17506

INFLUENCE OF SELF-SHIELDING ON EFFECTIVE BURNUP OF POISON PARTICLES IN A NEUTRON FLUX. C. P. Jamieson and F. C. Gaidos (Westinghouse Electric Corp., Pittsburgh). Nuclear Sci. and Eng. 2, No. 1, Suppl., 228-9(1959) June.

The self-shielding factors of boron carbide particles of several sizes were measured in the Reactivity Measurement Facility (RMF), and capsules containing these particles were irradiated in the MTR to study the effect of particle self-shielding on effective poison burnup. The self-shielding factor is defined as the ratio of the average flux in a particle, or system of particles, to the flux at a "large distance" from the sample. Self-shielding factors obtained by preirradiation reactivity measurements in a water hole in the RMF and in the fuel region are tabulated. (W.D.M.)

17507

SELF-SHIELDING FUNCTION FOR COMPOSITE GEOMETRIES. G. R. Hopkins and M. Bender (Westinghouse Electric Corp., Pittsburgh). Nuclear Sci. and Eng. 2, No. 1, Suppl., 229-30(1959) June.

A theoretical model for obtaining a system self-shielding factor for any number of composite geometries was developed from consideration of neutron interaction rates. The system factor is expressed as a product of self-shielding functions for the individual isolated geometries. The individual particle self-shielding and the mutual inter-particle self-shielding are taken into account. (W.D.M.)

17508

MICROSCOPIC SELF-SHIELDING IN MULTIPHASE MEDIUMS. C. H. Randall (Knolls Atomic Power Lab., Schenectady, N. Y.). Nuclear Sci. and Eng. 2, No. 1, Suppl., 230-1(1959) June.

A method is available for estimating the "microscopic self-shielding" in heterogeneous multiphase media, provided that the volume fractions of all but one phase are small and the phase geometries are fairly simple. A less restrictive method is demonstrated by making several simplifying assumptions. (W.D.M.)

17509

EXPERIMENTS ON SELF-SHIELDED BURNABLE POISONS. A. J. Calio and W. Baer (Westinghouse Electric Corp., Pittsburgh). Nuclear Sci. and Eng. 2, No. 1, Suppl., 231-2(1959) June.

A series of experiments was carried out to measure the thermal neutron activation distribution in regions of a critical assembly near and within enriched boron absorbers. From these measurements, the self-shielding factor was inferred. Two sets of experiments were carried out. In one, 2-in.-wide poison lumps constructed from B^{10}-coated Mylar tape were placed in the center of a seed region of a slab reactor. In the second, 0.36-in.-wide lumps were placed in the four corners of seed subassemblies in a mockup similar to the SPWR. (W.D.M.)

17510

ANALYSIS OF LUMPED BURNABLE POISON EXPERIMENTS WITH APPLICATIONS. J. D. Clement, J. H. Leonard, and N. G. Demas (Westinghouse Electric Corp., Pittsburgh). Nuclear Sci. and Eng. 2, No. 1, Suppl., 232-3(1959) June.

Results of criticality calculations and calculations of self-shielding factors are presented and are compared with experimental values. A simple method of relating the self-shielding factor to the absorption properties of the lump is discussed. Seed-blanket critical assemblies containing poison lumps per subassembly were analyzed using two-dimensional, four-energy-group theory. (W.D.M.)

17511

ONE-DIMENSIONAL DIFFUSION INTERMEDIATE REACTOR CODE (FIRE CODE). F. W. Brinkley and C. B. Mills (Los Alamos Scientific Lab., N. Mex.). Nuclear Sci. and Eng. 2, No. 1, Suppl., 234(1959) June.

The familiar age-diffusion equation was written in a flexible form for numerical integration on the IBM-704 (32K memory). One-dimensional slab, sphere, or cylinder geometries in annular homogeneous multi-region, multilethargy group configurations may be computed with hydrogen, continuous slowing-down, inelastic scattering, and neutron-temperature changes. Among the other features of the code are variable-extrapolation distance and the bare reactor approximations. (W.D.M.)

17512

NUMERICAL INTEGRATION OF THE SPHERICAL-HARMONICS EQUATIONS. J. Agresta, G. Goertzel, W. Guber, and H. Waldinger (Nuclear Development Corp. of America, White Plains, N. Y.). Nuclear Sci. and Eng. 2, No. 1, Suppl., 234-5(1959) June.

A method is proposed for integration of spherical harmonics equations which has been incorporated into a general-purpose digital computer code, PALINDROME, written for a Datatron 205. With a suitable definition of M and S, the code will solve a spherical-harmonics approximation of any order. Integration is accomplished by a five-point Adams-Bashforth scheme with a Runge-Kutta starting formula. The complexity of calculation is relatively independent of the order of approximation and completely independent of the number of regions. These affect only the time and storage required. (W.D.M.)

17513

A STUDY OF THE CONVERGENCE OF THE S_n APPROXIMATION FOR THERMAL SYSTEMS. E. Blue and H. P. Flatt (Atomics International Div., North American Aviation, Inc., Canoga Park, Calif.). Nuclear Sci. and Eng. 2, No. 1, Suppl., 235-6(1959) June.

When Carlson's S_n method is applied to many problems of interest (heterogeneous thermal reactors) in reactor analysis, the iterative procedure either does not converge or converges so slowly as to be of little practical use. The results of a study designed to accelerate the convergence of the S_n program for such problems are presented. Modifications to the code are described and effects considered. (W.D.M.)

17514

ON THE ACCELERATION OF MONTE CARLO CALCULATIONS. M. A. Martino (Knolls Atomic Power Lab., Schenectady, N. Y.). Nuclear Sci. and Eng. 2, No. 1, Suppl., 236-7(1959) June.

The two ways in which Monte Carlo computer calculations may be accelerated are discussed. The two types of acceleration, each of which may be considered independent of the other, are called subroutine acceleration and convergence acceleration. Subroutine acceleration is obtained by improvements in the design of the computer program to provide minimal computing time in the basic Monte Carlo steps. Convergence acceleration is obtained if the number of repetitions of the Monte Carlo routines necessary to obtain a prescribed accuracy is reduced by a transformation of one or more random variables in the problem. (W.D.M.)

17515

GRACE I—AN IBM 704-709 PROGRAM DESIGNED FOR COMPUTING GAMMA-RAY ATTENUATION AND HEATING IN REACTOR SHIELDS. D. S. Duncan and A. B. Speir (Atomics International Div., North American Aviation, Inc., Canoga Park, Calif.). Nuclear Sci. and Eng. 2, No. 1, Suppl., 237-8(1959) June.

The GRACE I code computes the gamma flux distribution in a multi-region finite or semi-infinite slab shield. The results are converted to either dose rates or heat-generation rates as desired. The code was programmed in the Fortran automatic coding system for either an IBM-704 with an 8000-word storage capacity or for an IBM-709. As many as 30 regions and 20 gamma energy groups may be included in a single calculation. (W.D.M.)

17516

A COMPUTER EXPERIMENT ON METHODS OF CONVERGENCE. S. W. Kitchen and E. L. Morgan (Knolls Atomic Power Lab., Schenectady, N. Y.). Nuclear Sci. and Eng. 2, No. 1, Suppl., 238(1959) June.

The complexity of problems being solved using digital computers become so great that it is frequently necessary to use the machine for the determination not only of the solution but of the proper method of obtaining this solution. An example of such a "computer experiment" is the investigation of the convergence characteristics of REM, a two-dimensional, three-group neutron diffusion theory code permitting non-orthogonal boundaries. (W.D.M.)

17517

A DIGITAL COMPUTER CODE FOR REACTOR HAZARDS ANALYSIS. J. C. Couchman (Convair, Fort Worth, Tex.). Nuclear Sci. and Eng. 2, No. 1, Suppl., 238-9(1959) June.

To facilitate reactor hazards predictions, numerical operations were programmed at Convair Fort Worth for the IBM-704. The code (D-45) is designed to calculate, for a reference area, the radiation hazard from a radioactive cloud created by isotopes which escape from a reactor on the end of a specified operating history. Computation may be made of the

fission product inventory of up to 50 isotopes and gross gamma activity built up over the operating history. (W.D.M.)

17518

GAMMA-HEATING PROGRAM FOR A HETEROGENEOUS CELL. J. F. Quinlan, M. D. McDonald, and J. R. Beeler (General Electric Co., Cincinnati). Nuclear Sci. and Eng. 2, No. 1, Suppl., 239-40(1959) June.

A detailed account of the gamma heating density is valuable in designing reactors wherein isolated high-density parts are embedded in low-density material which is relatively transparent to gamma radiation. A Monte Carlo method was developed to compute a detailed two-dimensional space map of the gamma-heating density in an infinite lattice generated by a three-region triangular symmetry cell. The average heating density is computed separately for the fuel region and one structural material region. A fine heating distribution along the length of the third region is also determined. (W.D.M.)

17519

GEOMETRICAL ASPECTS OF REACTOR-SHIELD-PENETRATION CALCULATIONS. R. L. French (Convair, Fort Worth, Tex.). Nuclear Sci. and Eng. 2, No. 1, Suppl., 240-1(1959) June.

To determine intercepted distances in complex geometries, a generalized machine procedure was developed which is based on symbolic logic rather than solution of geometrical equations. The procedure requires only 19 different major operations. High efficiency is achieved through multiple use of many of the operations in several loops. Use of the machine procedure requires that conventions be established for defining the geometrical shape of the various distinct regions encountered in a shield system. (W.D.M.)

17520

GAMMA HEATING IN FINITE HETEROGENEOUS CYLINDERS. D. R. Martin, J. M. Lutz, and J. R. Beeler (General Electric Co., Cincinnati). Nuclear Sci. and Eng. 2, No. 1, Suppl., 241-2(1959) June.

A straightforward Monte Carlo program was written which computes the gamma-heating density in a finite, heterogeneous, cylindrical reactor. In effect the computation progresses by first establishing implicitly the electron energy spectrum and spatial distribution associated with a given distributed gamma photon source. In the second phase of the computation the dispersal of the electron energy throughout the reactor is determined. (W.D.M.)

17521

EMPIRICAL FORMULAE FOR DETERMINING THERMAL NEUTRON FLUX DISTRIBUTIONS IN FINITE ABSORBING CYLINDERS. F. R. Taraba and S. H. Paine (Argonne National Lab., Lemont, Ill.). Nuclear Sci. and Eng. 2, No. 1, Suppl., 242-3(1959) June.

As internal temperature and distribution of radiation effects within irradiated fuel specimens are both directly related to the distribution of neutrons in the specimens, careful determinations of thermal neutron distributions in cylindrical bars were made. In the investigation natural uranium and alloys of Mg–Cd were used to explore neutron distributions. Effects of variable radius, a, and macroscopic absorption cross section, Σ_{abs}, in the range $0 \leq \mu \leq 2$, where $\mu = a\,\Sigma_{abs}$, were studied. (W.D.M.)

17522

ELEMENTARY CHARACTERIZATIONS OF THE WILKINS' SPECTRUM. B. I. Spinrad (Argonne National Lab., Lemont, Ill.) and E. R. Cohen (Atomics International Div., North American Aviation, Inc., Canoga Park, Calif.). Nuclear Sci. and Eng. 2, No. 1, Suppl., 243-4(1959) June.

Several attempts have been made in the past to force the non-Maxwellian neutron spectrum in an absorbing moderator into a Maxwellian distribution characterized by a temperature, T_n, and a slowing-down tail of Fermi age theory. These attempts have proven only partially successful. In order to understand the source of the difficulties, the elementary case of 1/v absorption and constant scattering cross sections is analyzed. (W.D.M.)

17523

THERMAL-NEUTRON SPECTRA IN POLYCRYSTALLINE GRAPHITE. D. E. Parks, D. H. Perkel, and N. F. Wikner (General Atomic Div., General Dynamics Corp., San Diego, Calif.). Nuclear Sci. and Eng. 2, No. 1, Suppl., 244(1959) June.

Recent developments in the theory of inelastic scattering of slow neutrons in crystals were adapted for studying the thermalization process in polycrystalline graphite. Specifically, an expression for the scattering kernel was obtained in the incoherent approximation and evaluated numerically by way of the phonon expansion. The multiple integrals occurring in the multiphonon terms are easily evaluated by assuming a specified frequency-distribution function for the solid. (W.D.M.)

17524

NEUTRON-ENERGY SPECTRUM STUDIES IN UNMODERATED ASSEMBLIES. George Fischer (Argonne National Lab., Lemont, Ill.). Nuclear Sci. and Eng. 2, No. 1, Suppl., 244-6(1959) June.

A procedure for flux determination is described which was applied to a study of the neutron spectrum in a dilute fast core of the ZPR-V and of the equilibrium neutron spectrum of natural uranium in a column of the LASL HYDRO Reactor. Atomic fission ratios determined by use of the four uranium isotopes U^{234}, U^{235}, U^{236}, and U^{238} quantitatively electrodeposited onto electrodes of small fission chambers provided the means of determining a four-group neutron-energy spectrum analysis for each assembly. (W.D.M.)

17525

SPECTRUM EFFECTS AT THE SURFACE OF WATER GAPS AND BLACK SLABS. W. B. Wright and F. Feiner (Knolls Atomic Power Lab., Schenectady, N. Y.). Nuclear Sci. and Eng. 2, No. 1, Suppl., 246(1959) June.

Detailed measurements of the neutron density were made near and at the interface of polyethylene and cadmium slabs bisecting homogeneous multiplying media, by activating 1/v absorbers. The effects of spectral hardening and H/metal ratios of the media were examined. Auxiliary experiments determining the epithermal flux in this region were made with Cd-covered In and Au foils. The experimental data are compared with calculations based on a number of different models of the neutron spectrum in the region of the spatial flux transients. (W.D.M.)

17526

NEUTRON SPECTRA IN HETEROGENEOUS REACTORS. W. Hafele (Oak Ridge National Lab., Tenn.). Nuclear Sci. and Eng. 2, No. 1, Suppl., 246-8(1959) June.

In an attempt to understand neutron spectra better, a plane finite heterogeneous reactor is considered with a finite odd number of fuel plates of width 2a. The results are proved by pure numerical calculations and the agreement is within error limits. (W.D.M.)

17527

FACTORS AFFECTING THERMAL-NEUTRON BEAMS FROM REACTORS. R. S. Carter (National Bureau of Standards, Washington, D. C.). Nuclear Sci. and Eng. 2, No. 1, Suppl., 248(1959) June.

Two methods for improving the thermal-to-fast neutron ratio in the beam from an H_2O moderated reactor are described. One method is to "split" the core so that there is no fuel in the central plane region from which the beam tube draws its current. Another method is to place an appropriate thickness of moderating material at the core end of the beam tube in order to slow down some of the fast neutrons coming directly from the fuel. These two methods were investigated experimentally using an 8-in. beam hole in the WTR. (W.D.M.)

17528

CALCULATION OF THE NEUTRON-LEAKAGE SPECTRA AND NEUTRON DOSE FROM BARE CRITICAL SYSTEMS. J. R. Knight (Oak Ridge Gaseous Diffusion Plant, Tenn.). Nuclear Sci. and Eng. 2, No. 1, Suppl., 249(1959) June.

A method for calculating the neutron spectra and neutron dose for highly-enriched unreflected uranium solutions at various H/U^{235} ratios was developed. The output from an IBM-704 code is used for criticality calculations, and the average leakage energy, the leakage spectra, the first-collision neutron dose, and the total neutron dose in rads per incident neutron flux are determined. The calculations cover a range of H/U^{235} atomic ratios from 0 to 2000. (W.D.M.)

17529

EFFECTIVE CADMIUM CUTOFFS FOR NEUTRONS. R. W. Stoughton, J. Halperin, and Majorie P. Lietzke (Oak Ridge National Lab., Tenn.). Nuclear Sci. and Eng. 2, No. 1, Suppl., 249-50(1959) June.

Effective cadmium cutoff energies were calculated for infinitely small 1/v samples at the centers of spherical and cylindrical cadmium shells. The definition of effective Cd cutoff energy used was the energy cutoff of a hypothetical perfect filter which would allow the same reaction rate for a 1/v absorber as the actual cadmium filter. The flux outside the shells was assumed to be a superposition of a Maxwellian thermal component and a 1/E epithermal component which went to zero at 5 times the energy E_m corresponding to the Maxwellian modal velocity. (W.D.M.)

17530

TRANSACTIONS OF THE AMERICAN NUCLEAR SOCIETY 1959 ANNUAL MEETING [HELD AT] GATLINBURG, TENNESSEE, JUNE 15-17, 1959. A Supplement to Nuclear Science and Engineering, Volume 2, Number 1, June 1959. J. G. Beckerley, ed. New York, Academic Press, Inc., 1959. 266p.

The Transactions are summaries of the technical papers presented at the annual meeting. Separate abstracts are prepared for the 210 papers. (W.D.M.)

17531

LES PILES ATOMIQUES A NEUTRONS LENTS. (Atomic Reactors With Slow Neutrons.) J. Maurin. Paris, Dunod, 1958. 205p.

The basic elements necessary for the complete neutron calculation of a preliminary reactor project are compiled for the reactor engineer. A first section gives a brief general view of reactor theory. The basis of reactor techniques is then defined. A thorough examination of neutron diffusion theory leads to an outline of the calculation of a reactor. An appendix presents the kinetic theory of gases applied to neutrons and tables of thermal neutron cross sections. (J.S.R.)

17532

RESEARCH AND DEVELOPMENT IN REACTOR SAFETY. B. John Garrick, ed. Washington, D. C., U. S. Atomic Energy Commission, 1959. 69p. $0.65 (GPO).

The reactor safety research program, including projects for theoretical support, is described. The general AEC reactor safety program is based primarily upon two postulated accidents which could lead to core meltdown and subsequent fission product release. These are loss of nuclear control and loss of coolant during power operation. The safety program activities fall into three catagories: kinetics and control, potential reactions, and containment. (A.C.)

Power

17533 AECU-4202

Duquesne Light Co., Shippingport, Penna.
START-UP AFTER SCRAM. SECTION I. Test Results DL-S-267 (T-641320). First issue, Apr. 30, 1959. 28p. $4.80(ph), $2.70(mf) OTS.

A test was made to determine the adequacy of present operating procedures for start-up of the reactor plant after a reactor scram. (J.E.D.)

17534 AECU-4203

Duquesne Light Co., Shippingport, Penna.
REACTOR REFUELING TEST. SECTION I. Test Results DL-S-256-S (RNI-1). First issue, Apr. 30, 1959. 7p. $1.80(ph), $1.80(mf) OTS.

The use of plastic tubing of either of two thicknesses for removal of an auxiliary seed exit water instrumentation assembly from the reactor pressure vessel fuel parts was determined. (J.E.D.)

17535 AECU-4204

Duquesne Light Co., Shippingport, Penna.
COOLANT CHARGING SYSTEM. SECTION II. Test Results DL-S-113 (T-550067). First Issue, Nov. 4, 1957, Second Issue, May 11, 1959. 5p. $1.80(ph), $1.80(mf) OTS.

Test results are presented on the reactor coolant charging system. All system components performed satisfactorily after the necessary adjustments or repairs were made. (J.E.D.)

17536 AECU-4205

Duquesne Light Co., Shippingport, Penna.
DETERMINING MARKINGS FOR FEDAL ACTIVITY RECORDERS. SECTION I. Test Results DL-S-265S (RNI-8). First issue, May 12, 1959. 5p. $1.80(ph), $1.80(mf) OTS.

Tests were made to provide sufficient information for making permanent recorder scales on the activity recorders for the FEDAL system. (J.E.D.)

17537 AECU-4206

Duquesne Light Co., Shippingport, Penna.
SAFETY RADIATION LEVEL SURVEY. SECTION II. THIRD PERFORMANCE. Test Results DL-S-157.

First Issue, May 12, 1959. 4p. $1.80(ph), $1.80(mf) OTS.

A determination was made of the level of the radiation field in the non-nuclear portion of the plant during a significant run. All radiation levels were found to be equivalent to background level readings, and no neutron level was present. (J.E.D.)

17538 AECU-4207
Duquesne Light Co., Shippingport, Penna.
NUCLEAR INSTRUMENTATION. SECTION I. Test Results DL-S-266-S (RNI-7). First Issue May 12, 1959. 4p. $1.80(ph), $1.80(mf) OTS.

The range of load resistance is determined for the channel A, B, and C power range linear amplifiers of the nuclear instrumentation system, for which there is a negligible change in indicated percent power produced when switching from the minimum level relay to the dummy load. (J.E.D.)

17539 AECU-4208
Duquesne Light Co., Shippingport, Penna.
CONTROL ROD POSITIONS FOR CRITICALITY. SECTION II. SECOND PERFORMANCE. Test Results DL-S-149 (T-550130). First Issue, May 12, 1959. 10p. $1.80(ph), $1.80(mf) OTS.

Critical bank heights and rod worths were determined for various rod configurations at normal plant operating temperature and pressure. Results are tabulated. (J.E.D.)

17540 AECU-4209
Duquesne Light Co., Shippingport, Penna.
PERIODIC RADIATION SURVEY OF REACTOR PLANT CONTAINER AND COMPONENTS AFTER SHUTDOWN "B" SURVEY. SECTION II. FIRST PERFORMANCE. Test Results DL-S-184 (T-612076). First Issue, May 19, 1959. 11p. $3.30(ph), $2.40(mf) OTS.

Radiation levels were determined at welds, thermoweld penetrations, and major components in the loops when the reactor was subcritical following an extended power run. (J.E.D.)

17541 AECU-4210
Duquesne Light Co., Shippingport, Penna.
ISOLATED LOOP WARM-UP USING HOLES IN THE CHECK VALVES. SECTION I. Test Results DL-S-212 (T-641116). First Issue, May 12, 1959. 11p. $3.30 (ph), $2.40(mf) OTS.

A determination was made of the feasibility of returning a warm coolant loop to operation by heating it using the backflow from the operating loops which passes through the hole in the check valve of the warm loop. (J.E.D.)

17542 AECU-4218
Duquesne Light Co., Shippingport, Penna.
NUCLEAR INSTRUMENTATION SYSTEM OPERATION SELECTOR SWITCH OPERATIONAL INFORMATION. SECTION I. Test Results DL-S-262-S (RNI-11). First issue, May 19, 1959. 8p. $1.80(ph), $1.80(mf) OTS.

The effect of positioning the operation selector switch (S501) of the intermediate range log microammeter in either the zero or rate cal positions when the test operate switch (S701) of the power range linear level amplifier is operated was determined. The test was performed before and after the installation of a resistor. The transients which resulted on the microammeter were small after the installation of the 27,000 Ω resistor. (auth)

17543 AECU-4219
Duquesne Light Co., Shippingport, Penna.
CHECKING ROD CONTROL SYSTEM INVERTERS FOLLOWING REPLACEMENT OF FACEPLATE COMMUTATORS. SECTION I. Test Results DL-S-263-S (RNI-12). First issue, May 19, 1959. 9p. $1.80(ph), $1.80(mf) OTS.

All inverters were checked, and satisfactory tracings were obtained of the voltage output of the inverters. All deficiencies were corrected, and the rod control system functioned satisfactorily. (auth)

17544 AECU-4220
Duquesne Light Co., Shippingport, Penna.
COOLANT CHARGING SYSTEM FILL PUMP TEMPERATURE SURVEY. SECTION I. Test Results DL-S-284-S (RNI-26). First issue, May 19, 1959. 7p. $1.80(ph), $1.80(mf) OTS.

This test was made to determine the temperatures at various locations on the shell of the coolant charging system fill pump when the pump was operated at shut off head. These data were to be used in the design of a by-pass line for the pump. Additional testing was performed to determine the temperature rise across the pump with varying amounts of flow. (auth)

17545 AECU-4224
Duquesne Light Co., Shippingport, Penna.
CANAL WATER SYSTEM. SECTION II. Test Results DL-S-138 (T-550092). First issue, May 25, 1959. 13p. $3.30(ph), $2.40(mf) OTS.

The Canal Water System performance test was completed satisfactorily. The performance of the reactor section sump pump and the vacuum cleaning pump did not meet the manufacturer's performance curves by amounts larger than can be accounted for by the accuracy of the test method. Data necessary to determine sump pump efficiencies were not obtained. (auth)

17546 AECU-4225
Duquesne Light Co., Shippingport, Penna.
CONTROL ROD POSITIONS FOR CRITICALITY. SECTION II. SIXTH PERFORMANCE. Test Results DL-S-149 (T-550130). First issue, May 25, 1959. 12p. $3.30(ph), $2.40(mf) OTS.

Determination was made of the critical heights and bank worths for various rod configurations at normal operating temperature and pressure conditions. (auth)

17547 AECU-4226
Duquesne Light Co., Shippingport, Penna.
CALIBRATION AND INTERCOMPARISON OF CONTROL RODS. SECTION II. Test Results DL-S-150 (T-550131). First issue, May 25, 1959. 150p. $22.80(ph), $7.20(mf) OTS.

A determination was made of the variation of certain plant parameters when a given power tilt was introduced across the core by positioning rods at opposite corners of the reactor at heights lower and higher than the controlling rod bank. In addition to the power tilt information, the power distribution was to be observed to determine if any power oscillation was introduced, upon returning the control rods to their normal positions, because of varying xenon conditions. As modified, the test provided information on the oscillation occurring when the flux tilt was suddenly removed, both as to period and amplitude. A power oscillation was introduced into the core when the control rods were repositioned after their deliberate misalignment.

The data indicate that the oscillation was not convergent and was probably divergent. As a direct result of this test and the instability exhibited, the reactor protection system is now operated normally in single channel. The reactor protection system set points have been changed so that for four loop operation the insertion set point is 119% rather than 138% and this safety shutdown set point is 138% rather than 175%. The three loop set points have remained the same. (auth)

17548 AECU-4227
Duquesne Light Co., Shippingport, Penna.
INTERCALIBRATION OF NUCLEAR INSTRUMENTATION. SECTION V. SECOND PERFORMANCE. Test Results DL-S-183 (T-612103). First issue May 25, 1959. 14p. $3.30(ph), $2.40(mf) OTS.

The linear level–power range meters operated properly and indicated the correct values within limits of plus or minus 10%. The results indicate that they are linear over their operating range. (auth)

17549 AECU-4228
Duquesne Light Co., Shippingport, Penna.
NUCLEAR INSTRUMENTATION SHUTDOWN SOURCE RANGE COUNTING RATE. SECTION I. Test Results DL-S-259-S (RNI-15). First issue, May 25, 1959. 6p. $1.80(ph), $1.80(mf) OTS.

The shutdown source range counting rate following prolonged operation at high power was determined. The neutron sources needed for the reactor core 1 seed 2 were evaluated. (auth)

17550 AECU-4229
Duquesne Light Co., Shippingport, Penna.
CORE I CONTROL ROD DRIVE MECHANISMS PERIODIC TESTS. SECTION I. FIRST THROUGH SEVENTH PERFORMANCES. Test Results DL-S-148 (T-550011). First issue, May 27, 1958. Second issue, June 12, 1959. 32p. $6.30(ph), $3.00(mf) OTS.

The operating conditions of the rod drive mechanisms so that operating personnel may be informed concerning malfunctioning mechanisms were determined. (auth)

17551 AECU-4231
Duquesne Light Co., Shippingport, Penna.
RIVER SOUNDINGS. SECTION I. Test Results DL-S-300. First issue, June 1, 1959. 4p. $1.80(ph), $1.80(mf) OTS.

The water depth in the intake channel to the screen house and the Ohio River near the intake channel was measured. The depth measurements indicated a sand bar. (auth)

17552 BAW-1017-1
Babcock and Wilcox Co. Atomic Energy Div., Lynchburg, Va.
A SUPPLEMENT TO THE LMFRE PRELIMINARY HAZARDS EVALUATION, BAW-1017. June 1959. 29p. Contract AT(30-1)-1940. $1.00(OTS).

The hazards of a circulating fuel reactor, liquid metal fuel type, were reevaluated in light of recent changes in plant design and containment philosophy. The maximum credible incident and its effects were analyzed to aid in selection of a site and to point out the degree of containment that is necessary. It was found that the major ingestion hazard due to a release of radioactive materials to the environment resulted mainly from the presence of polonium-210. Dose calculations indicate that the degree of containment specified for the plant will be adequate if the reactor is located at a distance of about ½ mi or more from edge of the site. Data reported in "Report of the LMFRE Site Selection Committee," November 1, 1957, indicate that this requirement can be satisfied essentially for the Dana, Brookhaven, and Camp Pickett sites. (auth)

17553 BAW-1052
Babcock and Wilcox Co. Atomic Energy Div., Lynchburg, Va.
LIQUID METAL FUEL REACTOR EXPERIMENT. Reference Design Report LMFRE-I. June 1958. 170p. Contract AT(30-1)-1940. $3.00(OTS).

The conceptual design is presented of an experimental liquid metal fuel reactor, which constitutes an important early step in a long-range development program leading to the first large-scale liquid metal fuel reactor power plant. Experimental reactors are necessary to provide answers to questions that cannot be supplied by out-of-pile experiments and in-pile radiation loops; e.g., the performance of materials in an integrated heat producing system with realistic radiation fields, and the kinetics of the reactor and associated heat rejection system. Since more than one experimental reactor is contemplated in the over-all development program, the first liquid metal fuel reactor experiment (LMFRE-I) need answer only basic questions–prototypic questions can be deferred and directed to a future reactor. A minimum reactor size is set by criticality requirements; the proper size of the system components is established by considerations of fluid dynamics, desirable fission density, availability of proposed components, and a reasonable degree of extrapolation of future larger reactors. The proposed reactor uses a circulating fuel of uranium (plus additives) dissolved in liquid bismuth, has an unclad graphite moderator, and generates 5 Mw of heat at the (nominal) design temperature conditions of 750°F inlet and 885°F outlet. The heat is transferred from the primary system to liquid bismuth used as a secondary heat-transport fluid, then is rejected to air. Systems external to the reactor are designed to allow component maintenance and/or replacement as necessary. To the extent possible, the design will permit the future substitution of a slurry fuel for the solution fuel. The reactor, primary system, heat rejection system, and auxiliary systems will be housed in a building erected on an existing AEC site. The building will contain a minimum of supporting facilities, such as remote maintenance equipment and storage pool, control room, fuel addition and removal equipment, adequate analytical facilities to permit safe reactor operation, and office accommodations for operating personnel. Supporting facilities external to the reactor building, such as machine shop, water supply, fire protection service, guard service, cafeteria, and general laboratory facilities are assumed already available at the selected reactor site. (auth)

17554 BAW-1104
Babcock and Wilcox Co. Atomic Energy Div., Lynchburg, Va.
LIQUID METAL FUEL REACTOR RESEARCH AND DEVELOPMENT PROGRAM. June 1958. 104p. Contract AT(30-1)-1940. $2.50(OTS).

A research and development program is outlined which would lead to the design of a large, liquid metal fuel, power reactor in 1968. The program sets forth the work required, a proposed schedule, and an estimate of costs. (D.E.B.)

17555 CF-58-1-52
Oak Ridge National Lab., Tenn.
THE UTILITY OF CRITICAL EXPERIMENTS IN DE-

SIGNING FOR REACTOR SAFETY IN THE HRE-3 PROGRAM. P. R. Kasten, M. W. Rosenthal, D. G. Thomas, and M. Tobias. Jan. 6, 1958. 8p. Contract [W-7405-eng-26]. $1.80(ph), $1.80(mf) OTS.

A discussion of the determination of criticality and reactor behavior as a function of fuel position is presented as a part of exploratory HRE-3 design considerations. It is pointed out that an experimental program should be aimed at an evaluation of reactor behavior in the event of slurry settling and/or two-phase solution separation, as well as under more uniform conditions. Data from high-temperature power experiments and information on criticality as a function of temperature and fuel distribution would aid in evaluating reactor safety and stability as a function of specific design. Utilization of HRT to obtain the information is recommended. (J.R.D.)

17556 CF-58-2-57

Oak Ridge National Lab., Tenn.

METALLOGRAPHIC EXAMINATION OF COMPONENTS AND COUPONS FROM HRP IN-PILE LOOP L-2-17—PART I. A. E. Richt. Feb. 18, 1958. 15p. Contract [W-7405-eng-26]. $3.30(ph), $2.40(mf) OTS.

Metallographic examinations of representative reactor components and coupons from HRP in-pile loop L-2-17 are reported. The loop operated for a total of 1136.8 hours at 300°C in beam hole HB-2 of the LITR. The results are discussed and tabulated. Photographs are also included. (J.R.D.)

17557 CF-58-4-30

Oak Ridge National Lab., Tenn.

METALLOGRAPHIC EXAMINATION OF COMPONENTS AND COUPONS FROM HRP IN-PILE LOOP L-4-18. A. E. Richt. Apr. 3, 1958. 16p. Contract [W-7405-eng-26]. $3.30(ph), $2.40(mf) OTS.

Metallographic examinations of representative components and coupons from HRP in-pile loop L-4-18 are reported. The loop operated for a total of 859.6 hours at 235°C in beam hole HB-4 of the LITR during which time the LITR logged 1926 Mwh, mostly at the 3 Mw level. The results are discussed and tabulated. Photographs are also included. (J.R.D.)

17558 CF-58-6-20

Oak Ridge National Lab., Tenn.

METALLOGRAPHIC EXAMINATION OF COMPONENTS AND COUPONS FROM HRP IN-PILE LOOP L-2-19. A. E. Richt. June 3, 1958. 20p. Contract [W-7405-eng-26]. $3.30(ph), $2.40(mf) OTS.

Metallographic examinations of representative components and coupons from HRP in-pile loop L-2-19 were completed. The loop operated for a total of 1149 hours at 280°C in beam hole HB-2 of the LITR. During this time the reactor logged 2705 Mwh. Several specimens from loop components were examined as well as a variety of coupons. (J.R.D.)

17559 CF-58-9-15

Oak Ridge National Lab., Tenn.

METALLOGRAPHIC EXAMINATION OF COMPONENTS AND COUPONS FROM HRP IN-PILE LOOP L-2-21—PART I. A. E. Richt. Sept. 2, 1958. 17p. Contract [W-7405-eng-26]. $3.30(ph), $2.40(mf) OTS.

Metallographic examinations of representative corrosion specimens and reactor component sections from HRP in-pile loop are reported. The loop was operated for a total of 889 hours at 280°C in beam hole HB-2 of the LITR, during which time the reactor logged 1710 Mwh of operation. The results are discussed and tabulated. Photographs are also included. (J.R.D.)

17560 CF-58-10-59

Oak Ridge National Lab., Tenn.

HEATING AND COOLING TESTS ON THE ORR HN-1 IN-PILE LOOP MOCKUP. A. J. Shor. Oct. 20, 1958. 9p. Contract [W-7405-eng-26]. $1.80(ph), $1.80(mf) OTS.

Heating and cooling tests were made on the ORR HN-1 in-pile loop mockup 0-1-20 to test the operation of the loop when subjected to reactor scrams or setbacks. The loop was fitted with additional heaters to simulate reactor heat. Reactor transients were simulated by manually changing the power at a predetermined rate. It was found that the loop control system was adequate and that loop temperatures could be maintained within a total change of 5°C. (auth)

17561 DP-383

Du Pont de Nemours (E. I.) & Co. Savannah River Lab., Aiken, S. C.

PRELIMINARY HAZARDS EVALUATION OF THE HEAVY WATER COMPONENTS TEST REACTOR (HWCTR). Daniel S. St. John, Louis J. Abate, L. M. Arnett, Ray R. Hood, Duncan Randall, Charles P. Ross, and James W. Wade. May 1959. 193p. Contract AT(07-2)-1. $3.00(OTS).

The Heavy Water Components Test Reactor (HWCTR) is designed to test as many as 12 natural uranium fuel assemblies, each 10 ft long, at power ratings and exposures expected in full-scale power reactors. The HWCTR is a pressurized reactor that is moderated and cooled with D_2O. The maximum power is 70 Mw, the maximum pressure is 1500 psi, and the maximum D_2O temperature is 290°C. A Preliminary Hazards Evaluation is presented in which the features of the reactor design that affect reactor safety are described. Representative accidents are postulated and their course followed through conditions in the reactor, action of the safety systems, and subsequent action of the emergency backup facilities. In the majority of accidents considered, the negative temperature coefficient of the moderator prevents serious consequences. In the case of a major break in the pressure system, the spread of radioactivity is limited by the containment building in which the reactor is housed. (auth)

17562 NAA-SR-3835

Atomics International Div., North American Aviation, Inc., Canoga Park, Calif.

A SURVEY OF THE DECOMPOSITION RATES OF ORGANIC REACTOR COOLANTS. R. H. J. Gercke and C. A. Trilling. June 10, 1959. 30p. Contract AT(11-1)-GEN-8. $0.75(OTS).

A comprehensive review has been conducted of the experimental values for organic coolant decomposition rates. Decomposition rates determined as the result of operation of the OMRE are included in addition to the results of in-pile loop, gamma, and electron irradiations. Similarities and differences in the results of various investigations are discussed. The interaction of the various particles of radiation with hydrocarbon liquids is reviewed with respect to the case of mixed in-pile irradiation. Recommended values are presented for the decomposition rate of organic reactor coolant. Values for G (polymer) are given as a function of polymer (high boiling compounds) content of the coolant and at temperatures of interest in organic reactors. Using the above recommended decomposition rates,

the coolant makeup rate and cost have been calculated for two designed organic reactor plants. For both a 150 Mw(e) and 300 Mw(e) plant the coolant makeup rate is 27 pounds per megawatt-day (thermal). Based on a coolant cost of $0.17 per lb, the makeup cost is 0.73 and 0.62 mills per kilowatt-hr (electrical), respectively. (auth)

17563 NARF-59-24T

Convair, Fort Worth, Tex.

A NUCLEAR GROUND SUPPORT EXPERIMENT WITH QUICK DISCONNECT DEVICES. P. L. Marjon. June 29, 1959. 25p. Project 6(1-9964). Contract AF53(600)-32054. (MR-N-247).

An experiment in remote handling was conducted to provide information on equipment needs for ground support of nuclear aircraft. Representative, commercially available components with quick-operation features were used in remote handling tests. An evaluation was made of the causes of difficulties encountered in remote operations. Recommendations are made to guide the design of handling equipment for nuclear airplane maintenance applications. (auth)

17564 ORNL-2653

Oak Ridge National Lab., Tenn.

THE HGCR-1, A DESIGN STUDY OF A NUCLEAR POWER STATION EMPLOYING A HIGH-TEMPERATURE GAS-COOLED REACTOR WITH GRAPHITE-UO_2 FUEL ELEMENTS. W. B. Cottrell, C. M. Copenhaver, H. N. Culver, M. H. Fontana, V. J. Kelleghan, and G. Samuels. July 28, 1959. 195p. Contract W-7405-eng-26. $3.50(OTS).

The preliminary design of a 3095-Mw(thermal), helium-cooled, graphite-moderated reactor employing graphite-UO_2 fuel elements was investigated. At design conditions, 1500°F reactor outlet gas would be circulated to eight steam generators to produce 1050°F, 1450-psi steam which would be converted to electrical power in eight 157-Mw(electrical) turbine-generators. The over-all efficiency of this nuclear power station is 36.5%. The significant activities released from the unclad graphite-UO_2 fuel appear to be less than 0.2% of those produced and would be equivalent to 0.002 curie/cm^3 in the primary helium circuit. The maintenance problems associated with this contamination level are discussed. A cost analysis indicates that the capital cost of this nuclear station per electrical kilowatt would be around $220, and that the production cost of electrical power would be 7.8 mills/kwhr. (auth)

17565 ORNL-2733

Oak Ridge National Lab., Tenn.

SPECIFICATIONS AND FABRICATION PROCEDURES ON EUROPIUM-BEARING ABSORBER RODS FOR REACTIVITY CONTROL IN CORE II OF SM-1. C. F. Leitten, Jr., R. J. Beaver, and J. E. Cunningham. July 29, 1959. 75p. Contract W-7405-eng-26. $2.25(OTS).

Neutron-absorbing rods containing europium will be utilized to maintain safety and control excess reactivity during operation of the second core loading of the Stationary Medium Power Reactor (SM-1), formerly designated as the Army Package Power Reactor (APPR-1). The specifications and fabrication procedures developed and adopted for manufacturing the prototype component are presented. The basic criteria on which the absorber rod was designed for radioactive service in 450°F pressurized water are presented along with a general description of the component. The technological factors, such as chemical compatibility, nuclear characteristics, and irradiation behavior which led to the selection of Eu_2O_3 as the absorber material, elemental stainless powders as the matrix material, and type 304 L stainless steel as the cladding material, are reviewed. Requirements for manufacturing the control rod absorber sections are outlined. Also detailed material specifications and dimensional requirements are provided. The fabrication procedures for manufacturing the component are presented in detail, and quality control measures adopted to consistently produce components within dimensional tolerances on a pilot-plant basis are described. Requirements for supplier qualification include the preparation and testing of full-sized plates and absorber assemblies. Trouble-free operation from such problems as inhomogeneity, excessive fragmentation, and stringering of the europium oxide, as well as sensitization and surface contamination of the cladding, and lack of metallurgical bonding of the composite plate, must be demonstrated. (auth)

17566 PRDC-TR-21

Power Reactor Development Co., Detroit.

MONTHLY TECHNICAL REPORT [FOR] MARCH 1959. 27p. Contract AT(11-1)-476. $4.80(ph), $2.70(mf) OTS.

The status of the design and fabrication of the major components being procured by APDA for the Reactor Components Test is shown. Difficulty was experienced during the final heat treatment of the U–2.75 wt. % Mo alloy blanket specimens. The burnup and operating temperatures of the irradiated fuel specimens are reported. Further studies were made on the design of the graphite shielding within the primary shield tank. Environs monitoring radioactivity tables are presented. (For preceding period see PRDC-TR-20.) (W.L.H.)

17567 WAPD-PWR-PC-1349

[Westinghouse Electric Corp. Bettis Plant, Pittsburgh.]

PWR SHIPPINGPORT NUCLEAR INSTRUMENTATION MODIFICATIONS AND CALIBRATIONS. R. H. Delgado. July 14, 1958. 39p. $6.30(ph), $3.00(mf) OTS.

Actual performance of source range nuclear instrumentation using BF_3 detectors was extremely close to the latest prediction of performance. Compensated ion chambers used for intermediate and power range instrumentation produced currents roughly 72 times greater than predicted. Source range sensitivity was reduced by removing three of the four BF_3 counter elements in each detector assembly. Intermediate range sensitivity was reduced by shielding the compensated ion chambers with boral. Further reduction of ion chamber current was obtained by reducing the amount of polyethylene between the boral shielding and the ion chambers. Boron trifluoride counter failure has been observed in counters manufactured by older techniques but not in those manufactured by current techniques. Intermediate range drift has been observed predominantly upscale thereby reducing source to intermediate range overlap; a solution has been postulated. Oscillations and switching transients have been found in the power range instrumentation and solutions have been found. Problems remain in nuclear instrumentation calibration in terms of absolute power level measurement, possible effects of previous power history over the past few hours, and inequality of ion chamber sensitivity versus inequality of flux distribution in the reactor as seen by the detectors. (auth)

17568

NUCLEAR ENERGY PROPULSION PLANT WITH GAS COOLED REACTOR FOR A 10,000 SHP TANKER.

K. Illies. Atomkernenergie 4, 213-18(1959) June. (In German)

A brief survey is given of the results of a study on a ship propulsion unit with a gas cooled reactor. The plant is operated on a gas turbine of the single cycle system with electric transmission. (J.S.R.)

17569

EXPLANATION OF THE GAS CIRCUIT OF A 10,000-SHP NUCLEAR ENERGY GAS TURBINE SHIP PROPULSION PLANT. Jürgen Busch. Atomkernenergie 4, 218-22(1959) June. (In German)

The suitability of various gases as the working gas in a nuclear propulsion plant is considered. Nitrogen was chosen, although the lowered price for helium might make it economically feasible in later designs. The gas cycle of the plant and the general design of the turbomachinery are reviewed. The nitrogen at a pressure of 450 psia is at a temperature of 1200°F in the reactor. The gas is then partly expanded in a five-stage axial flow turbine driving two single-stage radial flow compressors and partly expanded in a triple-stage axial flow turbine operating the main generator. The electrical circuitry of the plant is also considered. (J.S.R.)

17570

HEAT EXCHANGERS OF A NUCLEAR ENERGY GAS COOLED SHIP PROPULSION PLANT. Hans-G. Paul. Atomkernenergie 4, 222-6(1959) June. (In German)

The problems of calculation and construction of heat exchangers of a closed-cycle gas turbine nuclear propulsion plant for a tanker are shown. The heat removal from the reactor, the design of the heat exchanger (plate type), and the boiler design for steam generation (Butterworth plant and tank heating) are discussed in detail. (auth)

17571

THE REACTOR, ITS CONSTRUCTION AND CONTROL. Wolfgang Hübschmann. Atomkernenergie 4, 226-30 (1959) June. (In German)

The problems of the design and control of a high-temperature, gas-cooled reactor for tanker propulsion are considered. UO_2 was selected as fuel, Be as the canning material, and BeO as the moderator and reflector. A conventional control of the reactor with control rods is discussed, but the use of a neutron absorbing gas is also considered. The use of BF_3 in a pipe system inside the core appears feasible if certain safety precautions are provided. (J.S.R.)

17572

INSTALLATION OF A NUCLEAR ENERGY GAS TURBINE PLANT IN A TANKER. K. Gerold. Atomkernenergie 4, 235-8(1959) June. (In German)

The installation of the nuclear gas turbine plant in a tanker is considered. For the protection of the ship and crew, the whole gas cycle, including the reactor, turbines, generators, and auxiliary equipment, are placed in a spherical safety tank. The safety tank and the rest of the power plant are to be installed in the stern of the ship. The problems in the replacing of fuel elements are outlined. (auth)

17573

SELECTION OF STRUCTURAL MATERIALS FOR GAS COOLED SHIP REACTOR. W. Junkermann. Atomkernenergie 4, 238-41(1959) June. (In German)

The neutron physics and thermal characteristics of structural materials for small gas-cooled reactors are considered. A list of characteristic moderator data and a diagram of thermal strength values as a function of temperature are presented. (auth)

TECHNOLOGY

Raw Materials

17574 ORNL-2744

Oak Ridge National Lab., Tenn.

SOLVENT EXTRACTION OF URANIUM FROM REDUCTION SLAG SLURRY. A. D. Ryon and F. L. Daley. July 28, 1959. 22p. Contract W-7405-eng-26. $0.75(OTS).

The chemical feasibility of the Dapex and Amex solvent extraction processes for recovery of uranium from sulfuric acid leach slurry (20 wt. % solid) of magnesium reduction slag was demonstrated. Extraction isotherms show that only 3 to 4 theoretical stages are needed for good uranium recovery. Phase separation is rapid with virtually no emulsion if the mixing is controlled to disperse slurry in continuous solvent phase. In continuous countercurrent tests with the Dapex process using 5 extraction stages and 3 strip stages uranium recovery was 99.8%, and the product contained < 500 ppm of any one impurity. The solvent loss was less than 0.5 gal/1000 gal of slurry. The cost of chemicals for extraction, stripping, precipitation, and solvent loss was 13 cents per pound of uranium recovered. (auth)

17575 PM(S)-15

Gt. Brit. Springfields Works, Springfields, Lancs, England.

A REPORT OF RECENT WORK CARRIED OUT ON THE PROCESSING OF SOUTH AFRICAN CONCENTRATES. A. R. Morgan and G. W. Llewellyn. May 1954. 10p. (SWTC/R-71).

It has been shown that South African concentrates can be dissolved directly in nitric acid, and it is apparent that the existing plant feed system and cascade dissolvers may be used with only minor modifications. The high sulfate content of the concentrates can be reduced to a satisfactory level by the addition of solid barium nitrate at the dissolving stage. The resulting liquor after filtration is suitable for purification in the ether extraction plant without a preliminary peroxide precipitation stage. (auth)

17576

WHICH PROCESS TO FREE RARE EARTHS FROM RAW MONAZITE ORE. C. S. Cronan. Chem. Eng. 66, 62-4(1959) July 27.

A caustic soda process and a sulfuric acid process for separating rare earths and thorium compounds from monazite ore are discussed in relation to flexibilities of the processes, drawbacks, and separation procedures. (C.J.G.)